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DECEMBER 30, 2005 ★ VOLUME 56 ★ NUMBERS 27-37 & INDEX

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PROCEEDINGS

OF THE
CALIFORNIA ACADEMY OF SCIENCES
(Fourth Series)



CALIFORNIA
ACADEMY OF SCIENCES

FOUNDED 1853

SAN FRANCISCO, CALIFORNIA

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SCIENTIFIC PUBLICATIONS

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COVER IMAGE

From 1853 to 1906, when the Academy suffered the grievous loss of its handsome museum buildings as a result of the devastating earthquake and subsequent fire that swept San Francisco's downtown area, the Academy had been served by a number of exceptional persons as President of the fledgling organization. Each had distinguished himself as a scientist, mathematician, engineer, or in business, and most held administrative positions outside of the Academy. (Top row, left to right) Andrew Randall (1853–1856) had served as an assistant to Federal geologist David Dale Owen in the survey of the Wisconsin-Minnesota territories before coming to California, to Monterey; he was elected to the California State Legislature. Leander Ransom (missing portrait; 1856–1866) after a successful career as surveyor in Toledo, Ohio, came to California. He served as U.S. General Land Office deputy surveyor for Northern California, reporting to Samuel King, U.S. Surveyor General for California. Ransom wisely selected the summit of Mount Diablo as the initial point for a survey and then, during the hot summer of 1851, he laid out the meridian and baseline markers needed to initiate the triangulation survey of all of central California and western Nevada. Josiah Dwight Whitney (1867–1868) served for nearly a decade as head of the first official California Geological Survey. Earlier, he had done seminal work on the mineral wealth of the United States. In 1868 he left California for Harvard University. James Blake, M.D. (1869–1871) was a maverick naturalist, distinguished scientist, and M.D. Blake had accompanied Howard Stansbury on the 1849–50 exploration of the Great Salt Lake before coming to California where he established a medical practice first in Sacramento and then San Francisco. He was responsible for having introduced new procedures for fermentation to California's wine industry, transforming it from producing undistinguished wines to one that could compete with the best of Europe. (Second row, left to right) George Davidson (1872–1886), mathematician, was Chief of the Pacific Coast branch of the U.S. Coastal Survey, forerunner of the U.S. Coast and Geodetic Survey. Harvey Harkness (1898–1895), physician and surgeon, wrote extensively about fungi. David Starr Jordan (1896–1897, 1900–1902, 1909–1911), distinguished ichthyologist and first President of Stanford University. (Third row, left to right) William Ritter (1898–1899), University of California, invertebrate zoologist. William Alvord (1903–1904), though not a scientist, he had a long-standing interest in both science and art. A successful business entrepreneur, he served a term as mayor of San Francisco, served on the Board of Directors of the Bank of California, and on numerous city commissions. Eusebius Molera (1905–1908), San Francisco engineer with an abiding interest in Aztec history, also served as President *Pro tem* of the Academy's Board of Trustees.

ISSN 0068–547X

The Proceedings of the California Academy of Sciences accepts manuscripts for publication in the Natural Sciences that stress systematics and evolutionary biology and paleontology, biogeography, and biodiversity, also related areas in the Earth Sciences, such as biostratigraphy, regional and global tectonics as they relate to biogeography, and paleoclimatology, and topics in astrobiology, anthropology, as well as the history of science as they relate to institutions of natural history, to individuals, and to activities, such as expeditions and explorations, in the natural sciences.

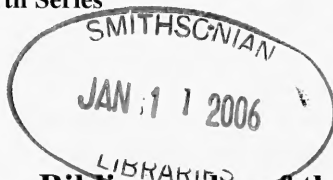
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Published by the California Academy of Sciences
875 Howard Street, San Francisco, California 94103 U.S.A.

Printed in the United States of America by
Allen Press Inc., Lawrence, Kansas 66044



A Checklist and Preliminary Bibliography of the Recent, Freshwater Diatoms of Inland Environments of the Continental United States

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This publication is dedicated to Dr. Eugene F. Stoermer on the occasion of his retirement.

A checklist of freshwater diatoms of inland environments of the continental United States is compiled. It includes over 4500 names across almost 170 genera. The genus *Navicula* has the greatest number of taxa recorded, followed by *Pinnularia*, *Nitzschia*, *Gomphonema*, and *Eunotia*. A preliminary bibliography of reports of diatoms from U.S. inland environments is also presented. The number of bibliographic entries is over 1,200, and includes reports from diverse publications. It is hoped that the checklist and bibliography can be used to develop a comprehensive diatom flora of the United States.

A challenge to documenting the Recent freshwater diatom flora of the United States is the lack of a synthesis of basic information. An understanding of the U.S. flora is important not only to assess the current state of our natural resources (in terms of biodiversity and subsequent changes due to changes in the physical, chemical and/or biological environment) but also to better understand the patterns of distribution within and outside the U.S.

Kociolek (submitted) has developed a list of taxa described from U.S. inland waters, and a comprehensive evaluation of all diatom names at the taxonomic level of species and below is forthcoming (Fourtanier & Kociolek, based on the approach for genus names developed by Fourtanier & Kociolek 1999, 2003). In addition to knowing what species have been described from the U.S., and the nomenclatural status of names, a third leg of the stool to begin a large-scale flora is a basic checklist of previously reported taxa. While many local and regional floras have been published (see Kociolek & Spaulding 2003 for a review of many of these), no comprehensive list of diatoms from the U.S. has been attempted in over 70 years (Boyer 1927a, b).

To develop a checklist for a region the size of the continental United States, a huge number of references had to be reviewed. A task such as this is daunting given the breadth of publications on U.S. diatoms reports that have been recorded. It was decided to develop in concert with the checklist, a bibliography of the references consulted, and to include them with the taxon compilation.

This current attempt could not be exhaustive, nor could it reconcile many of the discrepancies that are inherent in a preliminary checklist. It is hoped this listing provides a stepping stone forward to the development of a more accurate and, eventually, comprehensive understanding of the diatoms of inland environments of the United States.

METHODS

The listing of diatom names was derived from those reports of inland habitats in the United States. Names are recorded where names were full (at least genus and species) and accepted by the author. Names with question marks next to them or designated with a single letter or number have not been included. A reference citing each taxon in the list is provided; a complete set of references for each name was not attempted.

This listing of names reported in the literature, without original or cited interpretations means that there are redundancies in the names, either through taxonomic or nomenclatural synonymies. By nomenclatural (homotypic) synonymies, I mean there are different entries (names) based on a single type. Many of these occur in *Fragilaria*, *Synedra*, *Achnanthes*, *Brachysira*, *Anomoeoneis*, *Navicula* and others where there has been tremendous flux in the generic assignment of taxa. Despite the instability there has been in these names, much of this is well-known to those interested in diatom taxonomy, and they are more easily traced due to the way authors are listed after the taxon names in botanical nomenclature. Taxonomic (heterotypic) synonymies, where more than one name, based on two (or more) types for what is the same diatom, are much harder to recognize, and actually very little of the monographic work necessary to discover these conditions has been done. An example would be: *Gomphonema herculeanum* var. *robustum* Grunow has been shown to be the same diatom as *Gomphoneis herculeana* (Ehrenberg) Cleve (Kociolek & Stoermer 1988).

Another situation that could result in a proliferation of names is typographic and/or orthographic errors. Potential typographical errors were abundant in the literature consulted, and it is disconcerting to see how the same errors have been perpetuated from author to author. To reduce the number of entries due to these types of errors, I have, in some cases, made interpretations of these errors, especially in those situations when the context for the errors is more easy to interpret. For example, Loescher (1981, Table 1) lists "*Achnanthes lanceolate* (Bréb.) Grun. var. *lanceolata*" in her prairie samples, and I have treated this as an orthographic error for *Achnanthes lanceolata*. Likewise, Burkholder & Wetzel (1989) list "*Epithemia adriata* var. *proboscidea* (Kütz.) Patr. comb. nov." (interpreted here as *Epithemia adnata* var. *proboscidea*) and "*Fragilaria cortonensis* Kitt." (interpreted here as *Fragilaria crotonensis*), and as such I have not made separate entries for these orthographic errors.

I have not tracked synonymies in either the traditions of VanLandingham's *Catalogue* (1967-1979) or Camburn & Charles (2000). In most of the cases, there has actually been very little original research to support the nomenclatural combinations made or perpetuated. Monographic or revisionary studies, (including consultation of types) are needed to support the numerous nomenclatural changes made over the last decade or more.

References included in the bibliography were from the published literature only; no unpublished manuscripts, reports, theses or dissertations were included. In some cases, especially in the case of research reports issued from programs or centers based at universities or local government agencies, publication was not easy to ascertain. Experimental works *in situ* are cited, but references to artificial systems are not. Published exsiccatae are included. Paleolimnological studies are, generally, not included, except when surficial sediments were the focus of the study or report.

The basis for much of the literature surveyed was the Maillard Library and Diatom Collection Library of the California Academy of Sciences, the reprint collections of Van Landingham, Rushforth, and Stoermer (now all at CAS) and the published exsiccatae catalogue of Edgar (1987).

RESULTS AND DISCUSSION

Taxa

A total of 167 genera and nearly 4500 names of diatoms at the level of species, variety or form are included in the list of diatoms (Section II: Species List of Diatoms of the United States). *Navicula* has the largest number of names reported (over 900), followed by *Pinnularia* (340), *Nitzschia* (325), *Gomphonema* (237) and *Eunotia* (223). Over forty genera are represented by a single name, and fifteen have only two names represented. Although many of these entries are nomenclatural synonyms, it is interesting to note that many others represent newly discovered taxa, in the context of monographic revisions (Krammer 1992, 1997a, 1997b; 2002; Reichart 1999; Hamilton et al. 1995; Kociolek & Stoermer 1988), water quality studies (Potapova & Charles 2002, 2003; Morales 2003) and floristics (Stachura-Suchoples et al., accepted; Siver et al. 2005).

Given the geogaphic size and complexity of the continental United States, the number of taxa in this compilation would appear modest compared to the check list developed for Great Britain (Hartley et al. 1986) and continental Europe (Krammer & Lange-Bertalot 1986, 1988, 1991a, 1991b). That the U.S. flora has been developed almost exclusively with European taxon descriptions and keys (e.g., Hustedt 1927–1966, 1930), or with an incomplete flora (Patrick & Reimer 1966, 1975) may have resulted in fewer taxa being reported from the country.

References

Over 1,200 citations are included in the Bibliography. There are over 150+ years of publications represented in this literature. The range of venues used to publish diatom reports includes those focused on phycology, botany, water quality assessment, state and local governments, federal government, water engineering, state academies, zoology, microscopy, ecology, hydrobiology, limnology and even speleology. These references show the importance of state and private academies in the development of our knowledge of diatoms, especially the Academy of Natural Sciences of Philadelphia, and the Iowa Academy of Science. University centers have been Iowa State University, the University of Michigan, Bowling Green State University and Michigan State University, with faculty member at the latter three part of a lineage that has its roots at Iowa State and ANSP. Another important research center has been Brigham Young University.

Some of the earliest reports on diatoms from U.S. freshwaters including sites from both coasts (e.g., Ehrenberg 1854), and while there was tremendous development of our knowledge beyond these early works in the northeast, other places (like the deep South) have not yet developed significantly beyond the earliest reports.

Areas that have been well-studied include the east coast, midwest, Great Lakes, Utah and Great Smoky Mountains National Park. Less studied areas include the southeastern U.S. (east, central and west), Pacific Northwest, California, and the Intermountain region.

We are likely to associate investigation of water quality with the “green” period of the 1960s and 1970s, and there is a tremendous amount of literature relating to water quality issues from that period. However, there was significant attention and interest in the diatom communities of what we would now call eutrophic environments, especially as it related to sources of freshwater for human communities as far back as the late 19th century (e.g., Thomas & Chase 1887).

Concluding Remarks

The number of floristic studies of the U.S. freshwater flora is relatively few, given the size and diversity of the country. Recent floristic studies in some of the most relatively well-known areas, such as the east coast, continue to discover new taxa (Siver et al. 2005; Stachura-Suchoples et al.

accepted), and monographic studies on some of the larger, more robust species in the genus *Gomphonopsis* also identified many new taxa (Kociolek & Stoermer 1988). Thus, we still have a tremendous amount of work, floristic and monographic, to detail the diatoms of the U.S. Though the over 1,200 references included herein represent a large body of work, our knowledge of the flora has been constrained by the use of incomplete or European-based floras (Kociolek & Spaulding 2003).

I believe the majority of new discoveries of taxa will not only come from relatively unexplored areas of the country (such as the description of a new, apparently endemic genus from playa lakes in Arizona-Spaulding et al. 2002), but also from oligotrophic habitats. An indication of the potential for new discoveries from oligotrophic habitats comes from the work of Lange-Bertalot and Metzeltin (1996). They found in three oligotrophic lakes in Europe a total number of taxa equal to half of the total for all of Europe. Of the nearly 800 taxa found in these three oligotrophic lakes, over 125 were described as new or could not be assigned to known taxa.

It is imperative to better understand the biodiversity of diatoms in the United States. The roles they play in providing ecosystem services (base of the food chain, producers of oxygen) and their application to ecological problems, both theoretical and practical, provide strong rationales for a renewed commitment to develop the flora of the U.S. It is hoped this checklist, along with other tools, will facilitate work to the production of such a flora.

ACKNOWLEDGMENTS

I am indebted in many ways to Gene Stoermer for his advice, guidance, and friendship. His insistence on high scientific standards has proven helpful beyond scientific endeavors. Dr. Elisabeth Fourtanier offered a constructive review of this manuscript as did Dr. Michele Aldrich.

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Section II: Species List of Diatoms of the United States

Name	Publication
<i>Acanthoceras zachariasii</i> (Brun) Simonsen	Stoermer et al. 1999
<i>Achnanthes acares</i> Hohn & Hellerman	Patrick & Reimer 1966
<i>Achnanthes affinis</i> Grunow	Stoermer & Kreis 1978
<i>Achnanthes altaica</i> (Poretzky) A. Cleve	Stoermer et al. 1999
<i>Achnanthes americana</i> Cleve	Boyer 1927b
<i>Achnanthes amoena</i> Hustedt	Stoermer & Kreis 1978
<i>Achnanthes atacamae</i> Hustedt	Stoermer & Kreis 1978
<i>Achnanthes austriaca</i> Hustedt	Camburn 1982
<i>Achnanthes austriaca</i> var. <i>helvetica</i> Hustedt	Bateman & Rushforth 1984
<i>Achnanthes biasolettiana</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Achnanthes bicapitata</i> Hustedt	Camburn & Charles 2000
<i>Achnanthes biconfusa</i> Van Landingham	Camburn et al. 1978
<i>Achnanthes bioreti</i> Germain	Stoermer & Kreis 1978
<i>Achnanthes biporoma</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Achnanthes botnica</i> (Cleve) Cleve	Rushforth & Merkley 1988
<i>Achnanthes brevipes</i> C. Agardh	Stoermer et al. 1999
<i>Achnanthes brevipes</i> var. <i>intermedia</i> (Kützing) Cleve	Stoermer et al. 1999
<i>Achnanthes calcar</i> Cleve	Stoermer & Kreis 1978
<i>Achnanthes chlidanos</i> Hohn & Hellerman	Camburn 1982
<i>Achnanthes chilensis</i> var. <i>subaequalis</i> Reimer	Whitford & Schumacher 1973
<i>Achnanthes clevei</i> Grunow	Stoermer & Kreis 1978
<i>Achnanthes clevei</i> var. <i>rostrata</i> Hustedt	Stoermer & Kreis 1978
<i>Achnanthes coarctata</i> (Brébisson) Grunow	Stoermer & Kreis 1978
<i>Achnanthes conspicua</i> A. Mayer	Stoermer & Kreis 1978
<i>Achnanthes conspicua</i> var. <i>brevistriata</i> Hustedt	Stoermer & Kreis 1978
<i>Achnanthes coteriensis</i> Foged	Kaczmarek & Rushforth 1983
<i>Achnanthes crenulata</i> Grunow	Rushforth & Merkley 1988
<i>Achnanthes curvirostrum</i> Brun	Patrick & Reimer 1966
<i>Achnanthes dau</i> Foged	Potapova & Charles 2003
<i>Achnanthes decipiens</i> Reimer	Reimer 1966
<i>Achnanthes deflexa</i> Reimer	Stoermer & Kreis 1978
<i>Achnanthes deflexa</i> var. <i>alpestris</i> Lowe & Kociolek	Lowe & Kociolek 1984
<i>Achnanthes delicatula</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Achnanthes depressa</i> (Cleve) Hustedt	Stoermer et al. 1999
<i>Achnanthes detha</i> Hohn & Hellerman	Stoermer & Kreis 1978
<i>Achnanthes didyma</i> Hustedt	Stoermer & Kreis 1978
<i>Achnanthes dispar</i> Cleve	Stoermer & Kreis 1978
<i>Achnanthes dispar</i> var. <i>angulata</i> Hustedt	Stoermer et al. 1999

Name	Publication
<i>Achnanthes dispar</i> var. <i>fontellii</i> A. Cleve	Stoermer et al. 1999
<i>Achnanthes duthii</i> Screenivasa	Stoermer et al. 1999
<i>Achnanthes elliptica</i> var. <i>elongata</i> A. Cleve	Stoermer & Kreis 1978
<i>Achnanthes exigua</i> Grunow	Stoermer & Kreis 1978
<i>Achnanthes exigua</i> var. <i>constricta</i> (Grunow) Hustedt	Stoermer & Kreis 1978
<i>Achnanthes exigua</i> var. <i>elliptica</i> Hustedt	Potapova & Charles 2003
<i>Achnanthes exigua</i> var. <i>heterovalva</i> Krasske	Stoermer & Kreis 1978
<i>Achnanthes exigua</i> var. <i>heterovalva</i> f. <i>semiaperta</i> Guerneur	Stoermer & Kreis 1978
<i>Achnanthes exilis</i> Kützing	Stoermer & Kreis 1978
<i>Achnanthes flexella</i> (Kützing) Brun	Stoermer & Kreis 1978
<i>Achnanthes flexella</i> var. <i>alpestris</i> Brun	Stoermer et al. 1999
<i>Achnanthes gibberula</i> Grunow	Stoermer et al. 1999
<i>Achnanthes gracillima</i> Hustedt	Stoermer & Kreis 1978
<i>Achnanthes gracillina</i> var. <i>nipponica</i> Sovereign	Stoermer et al. 1999
<i>Achnanthes grana</i> Hohn & Hellerman	Patrick & Reimer 1966
<i>Achnanthes grimmei</i> Krasske	Patrick & Reimer 1966
<i>Achnanthes harveyi</i> Reimer	Camburn 1982
<i>Achnanthes hauckiana</i> Grunow	Stoermer & Kreis 1978
<i>Achnanthes hauckiana</i> var. <i>rostrata</i> Schulz	Stoermer & Kreis 1978
<i>Achnanthes helvetica</i> (Hustedt) Lange-Bertalot	Camburn & Charles 2000
<i>Achnanthes hettensis</i> A. Cleve	Stoermer & Kreis 1978
<i>Achnanthes hudsonis</i> Grunow in Van Heurck	Patrick & Reimer 1966
<i>Achnanthes hungarica</i> (Grunow) Grunow	Stoermer & Kreis 1978
<i>Achnanthes hustedtii</i> (Krasske) Reimer	Patrick & Reimer 1966
<i>Achnanthes imperfecta</i> Schimanski	Camburn & Charles 2000
<i>Achnanthes incognita</i> Krasske	Stoermer et al. 1999
<i>Achnanthes inflata</i> (Kützing) Grunow	Camburn 1982
<i>Achnanthes inflata</i> var. <i>elata</i> (Leud.-Fortm.) Hustedt	Patrick & Reimer 1966
<i>Achnanthes joursacense</i> Héribaud	Stoermer et al. 1999
<i>Achnanthes kolbei</i> Hustedt	Stoermer et al. 1999
<i>Achnanthes kryophila</i> Peterson	Stoermer & Kreis 1978
<i>Achnanthes kryophila</i> var. <i>africana</i> Cholnoky	Stoermer & Kreis 1978
<i>Achnanthes lanceolata</i> (Brébisson) Grunow	Stoermer & Kreis 1978
<i>Achnanthes lanceolata</i> var. <i>abbreviata</i> Reimer	Hansmann 1973
<i>Achnanthes lanceolata</i> var. <i>apiculata</i> Patrick	Stoermer & Kreis 1978
<i>Achnanthes lanceolata</i> var. <i>bimaculata</i> Hustedt	Stoermer & Kreis 1978
<i>Achnanthes lanceolata</i> var. <i>dubia</i> Grunow	Stoermer & Kreis 1978
<i>Achnanthes lanceolata</i> var. <i>elliptica</i> Cleve	Stoermer & Kreis 1978
<i>Achnanthes lanceolata</i> var. <i>fossilis</i>	Patrick 1968
<i>Achnanthes lanceolata</i> var. <i>genuina</i> A. Mayer	Stoermer & Kreis 1978
<i>Achnanthes lanceolata</i> var. <i>haynaldii</i> (Schaarsch.) Cleve	Camburn & Lowe 1978
<i>Achnanthes lanceolata</i> var. <i>lanceolatoides</i> (Sovereign) Reimer	Collins & Kalinsky 1977
<i>Achnanthes lanceolata</i> f. <i>minor</i> Schultz	Whitford & Schumacher 1973
<i>Achnanthes lanceolata</i> var. <i>omissa</i> Reimer	Stoermer & Kreis 1978
<i>Achnanthes lanceolata</i> var. <i>robusta</i> Hustedt	Stoermer & Kreis 1978
<i>Achnanthes lanceolata</i> var. <i>rhomboides</i> A. Mayer	Gaufin et al. 1976
<i>Achnanthes lanceolata</i> var. <i>rostrata</i> Hustedt	Camburn 1982
<i>Achnanthes lanceolata</i> f. <i>ventricosa</i> Hustedt	VanLandingham 1968
<i>Achnanthes lanceolatoides</i> Sovereign	Stoermer & Kreis 1978
<i>Achnanthes lapidosa</i> Krasske	Stoermer & Kreis 1978
<i>Achnanthes lapidosa</i> var. <i>appalachiana</i> (Camburn & Lowe) Lange-Bertalot	Camburn & Charles 2000
<i>Achnanthes lapidosa</i> var. <i>lanceolata</i>	Patrick & Roberts 1979
<i>Achnanthes lapponica</i> (Hustedt) Hustedt	Collins & Kalinsky 1977
<i>Achnanthes lapponica</i> var. <i>fennica</i> A. Cleve	Clark & Rushforth 1977
<i>Achnanthes lapponica</i> var. <i>ninckei</i> (Guerm. & Manguin) Reimer	Camburn 1982
<i>Achnanthes laterostrata</i> Hustedt	Stoermer & Kreis 1978
<i>Achnanthes laenburgiana</i> Hustedt	Stoermer & Kreis 1978

Name	Publication
<i>Achnanthes lemmermannii</i> Hustedt	Stoermer & Kreis 1978
<i>Achnanthes levanderi</i> Hustedt	Stoermer & Kreis 1978
<i>Achnanthes levanderi</i> var. <i>helvetica</i> Hustedt	Stoermer et al. 1999
<i>Achnanthes lewisiana</i> Patrick	Stoermer & Kreis 1978
<i>Achnanthes linearis</i> (W. Smith) Grunow	Stoermer & Kreis 1978
<i>Achnanthes linearis</i> var. <i>pusilla</i> Grunow	Stoermer & Kreis 1978
<i>Achnanthes linearis</i> f. <i>curta</i> H.L. Smith	Stoermer & Kreis 1978
<i>Achnanthes linearis</i> f. <i>linearis</i>	Andresen & Stoermer 1978
<i>Achnanthes lutheri</i> Hustedt	Hansmann 1973
<i>Achnanthes macrocephala</i> (Kützing) Grunow	Gaufin et al. 1976
<i>Achnanthes marginulata</i> Grunow	Stoermer & Kreis 1978
<i>Achnanthes microcephala</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Achnanthes minutissima</i> Kützing	Stoermer & Kreis 1978
<i>Achnanthes minutissima</i> var. <i>cryptocephala</i> Grunow	Stoermer & Kreis 1978
<i>Achnanthes minutissima</i> var. <i>macrocephala</i> Hustedt	Hohn & Hellerman 1963
<i>Achnanthes minutissima</i> var. <i>robusta</i> Hustedt	Stoermer & Kreis 1978
<i>Achnanthes monela</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Achnanthes montana</i> Krasske	Clark & Rushforth 1977
<i>Achnanthes nitiformis</i> Lange-Bertalot	Siver et al. 2005
<i>Achnanthes nodosa</i> A. Cleve	Stoermer & Kreis 1978
<i>Achnanthes nollii</i> Bock	Stoermer & Kreis 1978
<i>Achnanthes oblongella</i> Østrup	Camburn & Charles 2000
<i>Achnanthes oestrupii</i> (A. Cleve) Hustedt	Stoermer & Kreis 1978
<i>Achnanthes oestrupii</i> var. <i>lanceolata</i> Hustedt	Stoermer & Kreis 1978
<i>Achnanthes oestrupii</i> var. <i>parvula</i> Patrick	Patrick 1945
<i>Achnanthes oestrupii</i> var. <i>pungens</i> (A. Cleve) Lange-Bertalot	Stoermer et al. 1999
<i>Achnanthes orientalis</i> Petit	Rushforth & Merkley 1988
<i>Achnanthes pachypus</i> Montagne	Patrick & Reimer 1966
<i>Achnanthes peragalli</i> Brun & Héribaud	Stoermer & Kreis 1978
<i>Achnanthes peragalli</i> var. <i>fossilis</i> Tempère & Peragallo	Stoermer & Kreis 1978
<i>Achnanthes peragalli</i> var. <i>parvula</i> (Patrick) Reimer	Stoermer & Kreis 1978
<i>Achnanthes pericava</i> Carter	Gaiser & Johansen 2000
<i>Achnanthes pinnata</i> Hustedt	Stoermer & Kreis 1978
<i>Achnanthes ploenensis</i> Hustedt	Stoermer & Kreis 1978
<i>Achnanthes prava</i> Sovereign	Patrick & Reimer 1966
<i>Achnanthes procera</i> Hustedt	Stoermer & Kreis 1978
<i>Achnanthes pseudolinearis</i> Hustedt	Camburn 1982
<i>Achnanthes pseudoobliqua</i> Simonsen	Kalinsky 1983
<i>Achnanthes pseudotanensis</i> A. Cleve	Patrick & Reimer 1966
<i>Achnanthes pusilla</i> Grunow in Cleve & Grunow	Hamilton et al. 1992
<i>Achnanthes quadratarea</i> (Østrup) Möller ex Foged	Hamilton et al. 1992
<i>Achnanthes recurvata</i> Hustedt	Stoermer et al. 1999
<i>Achnanthes reimeri</i> Camburn	Camburn 1982
<i>Achnanthes rricula</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Achnanthes rosenstockii</i> Lange-Bertalot	Camburn & Charles 2000
<i>Achnanthes rostrata</i> Østrup	Hamilton et al. 1992
<i>Achnanthes rupestoides</i> Hohn	Patrick & Reimer 1966
<i>Achnanthes saxonica</i> Krasske	Patrick & Reimer 1966
<i>Achnanthes simplex</i> Hustedt	Kaczmarek & Rushforth 1983
<i>Achnanthes stewartii</i> Patrick	Camburn 1982
<i>Achnanthes subatomus</i> Hustedt	Hohn & Hellerman 1963
<i>Achnanthes subhudsonis</i> var. <i>kraeuselii</i> Cholnoky	Hohn & Hellerman 1963
<i>Achnanthes sublaevis</i> Hustedt	Stoermer & Kreis 1978
<i>Achnanthes sublaevis</i> var. <i>crassa</i> Reimer	Camburn 1982
<i>Achnanthes submarina</i> Hustedt	Kalinsky 1983
<i>Achnanthes subrostrata</i> Hustedt	Dodd 1987
<i>Achnanthes subrostrata</i> var. <i>appalachiana</i> Camburn & Lowe	Camburn 1982

Name	Publication
<i>Achnanthes subsaloides</i> Hustedt	Stoermer & Kreis 1978
<i>Achnanthes subsalsa</i> Petersen	Stoermer & Kreis 1978
<i>Achnanthes subsevilis</i> Kützing	Kalinsky 1983
<i>Achnanthes suchlandtii</i> Hustedt	Stoermer & Kreis 1978
<i>Achnanthes taeniata</i> Grunow in Cleve & Grunow	Patrick & Roberts 1979
<i>Achnanthes temperei</i> Peragallo in Tempère & Peragallo	Boyer 1927b
<i>Achnanthes thermalis</i> (Rabenhorst) Schonfeld	Stoermer et al. 1999
<i>Achnanthes trinodis</i> (W. Smith) Grunow	Stoermer & Kreis 1978
<i>Achnanthes tropica</i> Hustedt	Kaczmarek & Rushforth 1983
<i>Achnanthes ventralis</i> (Krasske) Lange-Bertalot	Stoermer et al. 1999
<i>Achnanthes ventraloconfusa</i> f. <i>simplex</i> Lange-Bertalot	Stoermer et al. 1999
<i>Achnanthes ventricosa</i> Ehrenberg	Tempère & Peragallo 1909
<i>Achnanthes wellsiae</i> Reimer	Stoermer & Kreis 1978
<i>Achnantheidium affine</i> (Grunow) Czarnecki	Stoermer et al. 1999
<i>Achnantheidium alpestre</i> (Lowe & Kociolek) Lowe & Kociolek in Johansen et al.	Potapova & Ponader 2004
<i>Achnantheidium bioreti</i> (Germain) Edlund	Stoermer et al. 1999
<i>Achnantheidium brevipes</i> var. <i>intermedia</i> (Kützing) Cleve	Stoermer et al. 1999
<i>Achnantheidium clevei</i> (Grunow in Cleve & Grunow) Czarnecki	Stoermer et al. 1999
<i>Achnantheidium clevei</i> var. <i>rostratum</i> (Hustedt) Edlund	Stoermer et al. 1999
<i>Achnantheidium crassum</i> (Hustedt) Potapova & Ponader	Potapova & Ponader 2004
<i>Achnantheidium deflexum</i> (Reimer) Kingston	Potapova & Charles 2003
<i>Achnantheidium delicatulum</i> Kützing	Stoermer et al. 1999
<i>Achnantheidium duthii</i> (Sreen.) Edlund	Stoermer et al. 1999
<i>Achnantheidium exiguum</i> (Grunow) Czarnecki	Stoermer et al. 1999
<i>Achnantheidium exiguum</i> var. <i>constrictum</i> (Grunow) Andresen et al.	Andresen et al. 2000
<i>Achnantheidium exiguum</i> var. <i>heterovalvum</i> (Krasske) Czarnecki	Stoermer et al. 1999
<i>Achnantheidium exilis</i> (Kützing) Bukhtiyarova	Stoermer et al. 1999
<i>Achnantheidium flexellum</i> (Kützing) Brébisson	Stoermer & Kreis 1978
<i>Achnantheidium hauckianum</i> (Grunow) Czarnecki	Stoermer et al. 1999
<i>Achnantheidium hungaricum</i> Grunow	Stoermer et al. 1999
<i>Achnantheidium kryophila</i> (Petersen) Bukhtiyarova	Stoermer et al. 1999
<i>Achnantheidium lanceolatum</i> Brébisson in Kützing	Stoermer et al. 1999
<i>Achnantheidium lanceolatum</i> var. <i>elliptica</i> Cleve	Stoermer et al. 1999
<i>Achnantheidium lanceolatum</i> var. <i>genuinum</i> Mayer	Stoermer et al. 1999
<i>Achnantheidium lanceolata</i> var. <i>haynaldii</i> (Schaarsch.) Cleve	Stoermer et al. 1999
<i>Achnantheidium lapponicum</i> Hustedt	Hohn 1951
<i>Achnantheidium levanderi</i> (Hustedt) Czarnecki	Stoermer et al. 1999
<i>Achnantheidium lineare</i> W. Smith	Stoermer et al. 1999
<i>Achnantheidium microcephalum</i> (Kützing) vide Rabenhorst	Stoermer et al. 1999
<i>Achnantheidium minutissimum</i> (Kützing) Czarnecki	Stoermer et al. 1999
<i>Achnantheidium peragalli</i> Brun & Héribaud in Héribaud	Stoermer et al. 1999
<i>Achnantheidium rivulare</i> Potapova & Ponader	Potapova & Ponader 2004
<i>Achnantheidium semiaperta</i> (Guermeur) Andresen et al.	Andresen et al. 2000
<i>Achnantheidium trinodis</i> Arnott ex Ralfs in Pritchard	Stoermer et al. 1999
<i>Actinella punctata</i> Lewis	Boyer 1927a
<i>Actinocyclus australis</i> Grunow	Tempère & Peragallo 1913
<i>Actinocyclus barkelyi</i> Grunow	Tempère & Peragallo 1913
<i>Actinocyclus niagarae</i> H.L. Smith	Stoermer & Kreis 1978
<i>Actinocyclus normanii</i> (Gregory) Hustedt	Stoermer et al. 1999
<i>Actinocyclus normanii</i> f. <i>subsalsa</i> (Juhl.-Dannf.) Hustedt	Stoermer et al. 1999
<i>Actinoptychus</i> sp.	Stoermer & Kreis 1978
<i>Adlafia suchlandtii</i> (Hustedt) Lange-Bertalot in Moser et al.	Johansen et al. 2004

Name	Publication
<i>Amphicampa eruca</i> Ehrenberg	Boyer 1927a
<i>Amphicampa hemicyclus</i> (Ehrenberg) Karsten	Rushforth & Merkley 1988
<i>Amphicampa mirabilis</i> Ehrenberg ex Ralfs	Patrick & Reimer 1966
<i>Amphipleura artica</i> Patrick & Freese	Stoermer & Kreis 1978
<i>Amphipleura kriegeriana</i> (Krasske) Hustedt	Stoermer et al. 1999
<i>Amphipleura lindheimeri</i> Grunow	Patrick & Reimer 1966
<i>Amphipleura pellucida</i> (Kützing) Kützing	Stoermer & Kreis 1978
<i>Amphipleura rutilans</i> (Trentepohl) Cleve	Rushforth & Merkley 1988
<i>Amphipleura sigmoidea</i> W. Smith	Stoermer & Kreis 1978
<i>Amphiprora alata</i> (Ehrenberg) Kützing	Stoermer & Kreis 1978
<i>Amphiprora calumetica</i> Thomas	Stoermer & Kreis 1978
<i>Amphiprora conspicua</i> Greville	Patrick & Reimer 1975
<i>Amphiprora costata</i> Hustedt	Whitford & Schumacher 1973
<i>Amphiprora navicularis</i> Ehrenberg	Ehrenberg 1856
<i>Amphiprora nereis</i> Lewis	Patrick & Reimer 1975
<i>Amphiprora ornata</i> J.W. Bailey	Stoermer & Kreis 1978
<i>Amphiprora paludosa</i> W. Smith	Stoermer & Kreis 1978
<i>Amphiprora pulchra</i> J.W. Bailey	J.W. Bailey 1851
<i>Amphitropis ornata</i> (J.W. Bailey) Grunow	Stoermer & Kreis 1978
<i>Amphitropis paludosa</i> var. <i>duplex</i> Donkin	Cleve & Möller 1879
<i>Amphitropis paludosa</i> var. <i>pokorniana</i> Grunow	Cleve & Möller 1879
<i>Amphora acutiuscula</i> Kützing	Patrick & Reimer 1975
<i>Amphora amphioxys</i> J.W. Bailey	Ehrenberg 1856
<i>Amphora angularis</i> Gregory	Kalinsky 1983
<i>Amphora angusta</i> Gregory	Patrick & Reimer 1975
<i>Amphora angusta</i> var. <i>oblongella</i> Grunow	Kalinsky 1983
<i>Amphora angusta</i> var. <i>ventricosa</i> (Gregory) Cleve	Kalinsky 1983
<i>Amphora aponina</i> Kützing	Patrick & Reimer 1975
<i>Amphora arcus</i> var. <i>sulcata</i> (A. Smith) Cleve	Kaczmarska & Rushforth 1983
<i>Amphora birugula</i> Hohn	Camburn 1982
<i>Amphora bullatoides</i> Hohn & Hellerman	Stoermer & Kreis 1978
<i>Amphora calumetica</i> (Thomas) M. Peragallo	Stoermer & Kreis 1978
<i>Amphora caroliniana</i> Giffen	Kalinsky 1983
<i>Amphora cistula</i> var. <i>maculata</i> (Kützing) Van Heurck	Prescott & Dillard 1979
<i>Amphora clevei</i> Grunow in A. Schmidt	Patrick & Reimer 1975
<i>Amphora coffeaeformis</i> (Agardh) Kützing	Stoermer & Kreis 1978
<i>Amphora coffeaeformis</i> var. <i>acutiuscula</i> (Kützing) Kützing	Stoermer & Kreis 1978
<i>Amphora coffeaeformis</i> var. <i>fossilis</i> Pantocsek	Kaczmarska & Rushforth 1983
<i>Amphora coffeaeformis</i> var. <i>perpusilla</i> Grunow	Kaczmarska & Rushforth 1983
<i>Amphora coffeaeformis</i> var. <i>salinarum</i> Grunow	Patrick & Reimer 1975
<i>Amphora cognata</i> Cholnoky	Rushforth & Merkley 1988
<i>Amphora commutata</i> Grunow	Stoermer & Kreis 1978
<i>Amphora crassa</i> Gregory	Rushforth & Merkley 1988
<i>Amphora crucifera</i> A. Cleve	Stoermer et al. 1999
<i>Amphora cruciferoides</i> Stoermer & Yang	Stoermer & Kreis 1978
<i>Amphora cymbifera</i> Gregory	Patrick & Reimer 1975
<i>Amphora delicatissima</i> Krasske	Stoermer & Kreis 1978
<i>Amphora delphina</i> L. W. Bailey	Boyer 1927b
<i>Amphora delphinea</i> var. <i>minor</i>	Tempère & Peragallo 1911
<i>Amphora exigua</i> Gregory	Stoermer & Kreis 1978
<i>Amphora fonticola</i> Maillard	Stoermer & Kreis 1978
<i>Amphora fontinalis</i> Hustedt	Camburn 1982
<i>Amphora fusca</i> A. Schmidt	Gaiser & Johansen 2000
<i>Amphora gigas</i> Ehrenberg	Stoermer & Kreis 1978

Name	Publication
<i>Amphora gracilis</i>	Ehrenberg 1856
<i>Amphora granulata</i> Gregory	Kalinsky 1983
<i>Amphora hemicycla</i> Stoermer & Yang	Stoermer & Kreis 1978
<i>Amphora holsatica</i> Hustedt	Patrick & Reimer 1975
<i>Amphora huronensis</i> Stoermer & Yang	Stoermer & Kreis 1978
<i>Amphora hyalina</i> Kützing	Kaczmarek & Rushforth 1983
<i>Amphora inariensis</i> Krammer	Stoermer et al. 1999
<i>Amphora libyca</i> Ehrenberg	Stoermer & Kreis 1978
<i>Amphora lineata</i> Gregory	Patrick & Reimer 1975
<i>Amphora lineolata</i> (Ehrenberg) Ehrenberg	Prescott & Dillard 1979
<i>Amphora macilenta</i> Gregory	Kaczmarek & Rushforth 1983
<i>Amphora marina</i> (W. Smith) Van Heurck	Rushforth & Merkle 1988
<i>Amphora menisca</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Amphora michiganensis</i> Stoermer & Yang	Stoermer & Kreis 1978
<i>Amphora montana</i> Krasske	Stoermer & Kreis 1978
<i>Amphora neglecta</i> Stoermer & Yang	Stoermer & Kreis 1978
<i>Amphora normanii</i> Rabenhorst	Stoermer & Kreis 1978
<i>Amphora ocellata</i>	Ehrenberg 1856
<i>Amphora oligotraphenta</i> Lange-Bertalot	Stoermer et al. 1999
<i>Amphora ovalis</i> (Kützing) Kützing	Stoermer & Kreis 1978
<i>Amphora ovalis</i> var. <i>affinis</i> (Kützing) Van Heurck ex De Toni	Camburn 1982
<i>Amphora ovalis</i> var. <i>constricta</i> Skvortzow	Stoermer & Kreis 1978
<i>Amphora ovalis</i> var. <i>gracilis</i> (Ehrenberg) Van Heurck	Stoermer & Kreis 1978
<i>Amphora ovalis</i> var. <i>libyca</i> (Ehrenberg) Cleve	Stoermer & Kreis 1978
<i>Amphora ovalis</i> var. <i>minor</i> H.H. Chase	Stoermer & Kreis 1978
<i>Amphora ovalis</i> var. <i>minutissima</i> (W. Smith) Hurter	Stoermer & Kreis 1978
<i>Amphora ovalis</i> var. <i>pediculus</i> (Kützing) Van Heurck	Stoermer & Kreis 1978
<i>Amphora parallelistriata</i> Manguin	Stoermer & Kreis 1978
<i>Amphora parallelistriata</i> var. <i>manguinii</i> Carter	Clark & Rushforth 1977
<i>Amphora pediculus</i> var. <i>minor</i> Grunow	Whitford & Schumacher 1973
<i>Amphora pellucida</i> Gregory	Patrick & Reimer 1975
<i>Amphora perpusilla</i> (Grunow) Grunow	Stoermer & Kreis 1978
<i>Amphora proteus</i> Gregory	Patrick & Reimer 1975
<i>Amphora proteus</i> var. <i>oculata</i> Peragallo	Kaczmarek & Rushforth 1983
<i>Amphora rimosa</i> Ehrenberg	Patrick & Reimer 1975
<i>Amphora rotunda</i> Skvortzow	Stoermer & Kreis 1978
<i>Amphora sabiniana</i> Reimer	Patrick & Reimer 1975
<i>Amphora salina</i> W. Smith	Elmore 1922
<i>Amphora sibirica</i> Skvortzow in Skvortzow & Meyer	Stoermer & Kreis 1978
<i>Amphora subcostulata</i> Stoermer & Yang	Stoermer & Kreis 1978
<i>Amphora submontana</i> Hustedt	Camburn 1982
<i>Amphora tenerrima</i> Hustedt	Kalinsky 1983
<i>Amphora tenuissima</i> Hustedt	Kaczmarek & Rushforth 1983
<i>Amphora tenuistriata</i> Manguin	Hohn & Hellerman 1963
<i>Amphora thermalis</i> Hustedt	Drum 1981
<i>Amphora thumensis</i> (Mayer) A. Cleve	Stoermer et al. 1999
<i>Amphora turgida</i> Gregory	Patrick & Reimer 1975
<i>Amphora veneta</i> Kützing	Stoermer & Kreis 1978
<i>Amphora veneta</i> var. <i>angularis</i>	Stoermer & Kreis 1978
<i>Amphora veneta</i> var. <i>capitata</i> Haworth	Stoermer & Kreis 1978
<i>Amphora ventricosa</i> Gregory	Kalinsky 1983
<i>Aneumastus carolinianus</i> (Patrick) Lange-Bertalot	Lange-Bertalot 2001
<i>Aneumastus minor</i> (Hustedt) Lange-Bertalot	Stoermer et al. 1999
<i>Aneumastus stroesei</i> (Østrup) Mann in Round et al.	Stoermer et al. 1999
<i>Aneumastus tusculus</i> (Ehrenberg) Mann in Round et al.	Stoermer et al. 1999
<i>Aneumastus tusculus</i> f. <i>minor</i> (Hustedt) Andresen et al.	Andresen et al. 2000

Name	Publication
<i>Aneumastus tusculus</i> f. <i>obtusum</i> (Hustedt) Andresen et al.	Andresen et al. 2000
<i>Aneumastus tusculus</i> var. <i>rostratus</i> (Hustedt) Andresen et al.	Andresen et al. 2000
<i>Anomoeoneis brachysira</i> (Brébisson) Grunow	Camburn & Charles 2000
<i>Anomoeoneis brachysira</i> var. <i>zellensis</i> (Grunow) Krammer	Camburn & Charles 2000
<i>Anomoeoneis costata</i> (Kützing) Hustedt	Stoermer & Kreis 1978
<i>Anomoeoneis exilis</i> Kützing	Stoermer & Kreis 1978
<i>Anomoeoneis exilis</i> var. <i>lanceolata</i> A. Mayer	Bateman & Rushforth 1984
<i>Anomoeoneis exilis</i> var. <i>thermalis</i> (Grunow) Cleve	Patrick & Reimer 1966
<i>Anomoeoneis fogedii</i> Reimer	Reimer 1982
<i>Anomoeoneis follis</i> (Ehrenberg) Cleve	Stoermer & Kreis 1978
<i>Anomoeoneis follis</i> var. <i>hannae</i> Reimer	Patrick & Reimer 1966
<i>Anomoeoneis follis</i> var. <i>fossilis</i> Reimer	Patrick & Reimer 1966
<i>Anomoeoneis paludigena</i> Scherer	Scherer 1988
<i>Anomoeoneis polygramma</i> (Ehrenberg) Cleve	Rushforth & Merkley 1988
<i>Anomoeoneis polygramma</i> var. <i>platensis</i> Frenguelli	Patrick & Reimer 1966
<i>Anomoeoneis sculpta</i> (Ehrenberg) O. Müller	Stoermer & Kreis 1978
<i>Anomoeoneis sculpta</i> var. <i>major</i> Cleve	Patrick & Reimer 1966
<i>Anomoeoneis serians</i> Brébisson	Stoermer & Kreis 1978
<i>Anomoeoneis serians</i> f. <i>undulata</i> Hustedt	Hustedt 1959
<i>Anomoeoneis serians</i> var. <i>acuta</i> Hustedt	Hansmann 1973
<i>Anomoeoneis serians</i> var. <i>apiculata</i> (Lewis) Boyer	Boyer 1927b
<i>Anomoeoneis serians</i> var. <i>brachysira</i> (Brébisson) Hustedt	Stoermer & Kreis 1978
<i>Anomoeoneis serians</i> var. <i>brachysira</i> f. <i>thermalis</i> (Grunow) Hustedt	Sovereign 1958
<i>Anomoeoneis serians</i> var. <i>minor</i> Grunow	Boyer 1927b
<i>Anomoeoneis sphaerophora</i> (Ehrenberg) Pfitzer	Stoermer & Kreis 1978
<i>Anomoeoneis sphaerophora</i> var. <i>biceps</i> Ehrenberg	Ehrenberg 1856
<i>Anomoeoneis sphaerophora</i> f. <i>costata</i> (Kützing) A.M. Schmid	Stoermer et al. 1999
<i>Anomoeoneis sphaerophora</i> var. <i>guentheri</i> O. Müller	Patrick & Reimer 1966
<i>Anomoeoneis sphaerophora</i> var. <i>minor</i> Kociolek & Herbst	Kociolek & Herbst 1992
<i>Anomoeoneis sphaerophora</i> var. <i>sculpta</i> (Ehrenberg) O. Müller	Stoermer & Kreis 1978
<i>Anomoeoneis styriaca</i> (Grunow) Hustedt	Stoermer & Kreis 1978
<i>Anomoeoneis variabilis</i> (Ross) Reimer	Reimer 1966
<i>Anomoeoneis vitrea</i> (Grunow) Ross	Stoermer & Kreis 1978
<i>Anomoeoneis vitrea</i> f. <i>lanceolata</i> (A. Mayer) Mogh	Gaufin et al. 1976
<i>Anomoeoneis vitrea</i> var. <i>gomphonemacea</i> (Grunow) Mogh	Gaufin et al. 1976
<i>Anomoeoneis zellensis</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Anomoeoneis zellensis</i> f. <i>difficilis</i> (Grunow in Van Heurck) Hustedt	Stoermer et al. 1999
<i>Anorthoneis dulcis</i> Hein	Hein 1991
<i>Asterionella bleakleyi</i> W. Smith	Stoermer & Kreis 1978
<i>Asterionella formosa</i> Hassall	Stoermer & Kreis 1978
<i>Asterionella formosa</i> var. <i>acaroides</i> Lemmerman	Stoermer & Kreis 1978
<i>Asterionella formosa</i> var. <i>gracillima</i> (Hantzsch) Grunow in Van Heurck	Stoermer & Kreis 1978
<i>Asterionella formosa</i> var. <i>subtilis</i> Grunow	Stoermer & Kreis 1978
<i>Asterionella formosa</i> var. <i>subtilissima</i> Grunow	Starrett & Patrick 1952
<i>Asterionella gracillima</i> (Hantzsch) Heiberg	Stoermer & Kreis 1978
<i>Asterionella ralfsii</i> W. Smith	Patrick 1945
<i>Asterionella ralfsii</i> var. <i>americana</i> Korner	Dixit & Smol 1995
<i>Attheya zachariasii</i> Brun	Stoermer & Kreis 1978
<i>Aulacoseira agassizii</i> (Ostenfeld) Simonsen	Stoermer et al. 1999
<i>Aulacoseira agassizii</i> var. <i>malayensis</i> (Hustedt) Simonsen	Stoermer et al. 1999
<i>Aulacoseira alpigena</i> (Grunow) Krammer	Stoermer et al. 1999
<i>Aulacoseira ambigua</i> (Grunow) Simonsen	Stoermer et al. 1999

Name	Publication
<i>Aulacoseira canadensis</i> (Hustedt) Simonsen	Stoermer et al. 1999
<i>Aulacoseira crassipunctata</i> Krammer	Camburn & Charles 2000
<i>Aulacoseira distans</i> (Ehrenberg) Simonsen	Stoermer et al. 1999
<i>Aulacoseira distans</i> var. <i>africana</i> (O. Müller) Simonsen	Hamilton et al. 1992
<i>Aulacoseira distans</i> var. <i>alpigena</i> (Ehrenberg) Simonsen	Camburn 1982
<i>Aulacoseira distans</i> var. <i>limnetica</i> (O. Müller) Simonsen	Stoermer et al. 1999
<i>Aulacoseira distans</i> var. <i>navalis</i> (W. Smith) Haworth	Camburn & Charles 2000
<i>Aulacoseira distans</i> var. <i>nivaloides</i> (Camburn) Haworth	Hamilton et al. 1992
<i>Aulacoseira distans</i> var. <i>septentrionalis</i> Camburn & Charles	Camburn & Charles 2000
<i>Aulacoseira distans</i> var. <i>tenella</i> (Nygaard) Ross in Hartley	Hamilton et al. 1992
<i>Aulacoseira granulata</i> (Ehrenberg) Simonsen	Camburn 1982
<i>Aulacoseira granulata</i> var. <i>angustissima</i> (O. Müller) Simonsen	Camburn 1982
<i>Aulacoseira granulata</i> var. <i>angustissima</i> f. <i>spiralis</i> (Hustedt) Czarnecki & Reinke	Stoermer et al. 1999
<i>Aulacoseira granulata</i> var. <i>muzzanensis</i> (Meister) Simonsen	Stoermer et al. 1999
<i>Aulacoseira herzogii</i> Lemmermann	Hickel & Håkansson 1991
<i>Aulacoseira humilis</i> (Cleve-Euler) Simonsen	Camburn & Charles 2000
<i>Aulacoseira islandica</i> (O. Müller) Simonsen	Stoermer et al. 1999
<i>Aulacoseira islandica</i> subsp. <i>helvetica</i> (O. Müller) Simonsen	Stoermer et al. 1999
<i>Aulacoseira italica</i> (Ehrenberg) Simonsen	Stoermer et al. 1999
<i>Aulacoseira italica</i> var. <i>tenuissima</i> (Grunow) Simonsen	Stoermer et al. 1999
<i>Aulacoseira italica</i> var. <i>valida</i> (Grunow) Simonsen	Stoermer et al. 1999
<i>Aulacoseira italica</i> subsp. <i>subarctica</i> (O. Müller) Simonsen	Stoermer et al. 1999
<i>Aulacoseira lacustris</i> (Grunow) Krammer	Camburn & Charles 2000
<i>Aulacoseira lirata</i> (Ehrenberg) Kützing	Hamilton et al. 1992
<i>Aulacoseira lirata</i> var. <i>biseriata</i> (Grunow) Haworth	Hamilton et al. 1992
<i>Aulacoseira lirata</i> var. <i>lacustris</i> (Grunow) Ross in Haartley	Hamilton et al. 1992
<i>Aulacoseira lirata</i> var. <i>alpigena</i> (Grunow) Haworth	Stoermer et al. 1999
<i>Aulacoseira lirata</i> var. <i>perglabra</i> (Østrup) Ross in Hartley	Hamilton et al. 1992
<i>Aulacoseira lirata</i> var. <i>perglabra</i> f. <i>florinae</i> (Camburn) Haworth	Hamilton et al. 1992
<i>Aulacoseira nygaardii</i> (Camburn) Camburn in Camburn & Charles	Hamilton et al. 1992
<i>Aulacoseira perglabra</i> (Østrup) Haworth	Camburn & Charles 2000
<i>Aulacoseira perglabra</i> var. <i>florinae</i> (Camburn) Haworth	Camburn & Charles 2000
<i>Aulacoseira subarctica</i> (O. Müller) Haworth	Stoermer et al. 1999
<i>Aulacoseira tenella</i> (Nygaard) Simonsen	Camburn & Charles 2000
<i>Aulacoseira valida</i> (Grunow) Krammer	Stoermer et al. 1999
<i>Bacillaria furcata</i>	Ehrenberg 1856
<i>Bacillaria cuneata</i>	Ehrenberg 1856
<i>Bacillaria paradoxa</i> Gmelin	Stoermer & Kreis 1978
<i>Bacillaria paradoxa</i> var. <i>tumidula</i> Grunow	Collins & Kalinsky 1977
<i>Bacillaria paxillifer</i> (O.F. Müller) Hendey	Stoermer & Kreis 1978
<i>Bacillaria vulgaris</i>	Ehrenberg 1856
<i>Biddulphia laevis</i> Ehrenberg	Camburn 1982
<i>Biddulphia polymorpha</i> Ehrenberg	Whitford 1956
<i>Biremis circumtexta</i> (Meister) Lange-Bertalot & Witkowski	Potapova & Charles 2003
<i>Biremis undulata</i> (Schulz) Andresen et al.	Edlund et al. 2001
<i>Biremis zachariasi</i> (Reichel) Edlund et al.	Edlund et al. 2001
<i>Brachysira aponina</i> Kützing	Kaczmarek & Rushforth 1983
<i>Brachysira arctoborealis</i> Wolfe & Kling	Wolfe & Kling 2001
<i>Brachysira brebissonii</i> Ross	Potapova & Charles 2003
<i>Brachysira exilis</i> (Kützing) Round & D.G. Mann	Stoermer et al. 1999
<i>Brachysira exilis</i> f. <i>undulata</i> Kisselev	Kaczmarek & Rushforth 1983
<i>Brachysira follis</i> (Ehrenberg) R. Ross in Hartley	Stoermer et al. 1999
<i>Brachysira gravida</i> Shayler & Siver	Shayler & Siver 2004

Name	Publication
<i>Brachysira brebissonii</i> R. Ross in Hartley	Stoermer et al. 1999
<i>Brachysira microcephala</i> (Grunow) Compère	Potapova & Charles 2003
<i>Brachysira neoacuta</i> Lange-Bertalot	Gaiser & Johansen 2000
<i>Brachysira neoexilis</i> Lange-Bertalot	Potapova & Charles 2002
<i>Brachysira serians</i> (Brébisson ex Kützing) Round & D.G. Mann	Stoermer et al. 1999
<i>Brachysira serians</i> var. <i>acuta</i> (Hustedt) Hamilton in Hamilton et al.	Hamilton et al. 1992
<i>Brachysira sphaerophora</i> (Kützing) Round & D.G. Mann	Stoermer et al. 1999
<i>Brachysira styriaca</i> (Grunow in Van Heurck) R. Ross in Hartley	Stoermer et al. 1999
<i>Brachysira vitrea</i> (Grunow) R. Ross in Hartley	Stoermer et al. 1999
<i>Brachysira zellensis</i> (Grunow) Round & D.G. Mann	Stoermer et al. 1999
<i>Brachysira zellensis</i> f. <i>difficilis</i> (Grunow in Van Heurck) Hamilton in Hamilton et al.	Stoermer et al. 1999
<i>Brebissonia boeckii</i> (Ehrenberg) Grunow	Boyer 1927b
<i>Brebissonia interposita</i> (Lewis) Kuntze	Elmore 1922
<i>Brebissonia palmeri</i> Boyer	Smith 1950
<i>Brebissonia vulgaris</i> (Thwaites) Van Heurck	Elmore 1922
<i>Caloneis aequatorialis</i> Hustedt	Dodd 1987
<i>Caloneis aerophila</i> Bock	Collins & Kalinsky 1977
<i>Caloneis alpestris</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Caloneis amphisbaena</i> (Bory) Cleve	Stoermer & Kreis 1978
<i>Caloneis amphisbaena</i> var. <i>subsalina</i> (Donkin) Cleve	Hohn 1951
<i>Caloneis bacillaris</i> (Gregory) Cleve	Stoermer & Kreis 1978
<i>Caloneis bacillaris</i> var. <i>thermalis</i> (Grunow) A. Cleve	Stoermer & Kreis 1978
<i>Caloneis bacillum</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Caloneis bacillum</i> var. <i>angusta</i> A. Mayer	Dodd 1987
<i>Caloneis bacillum</i> f. <i>fonticola</i> (Grunow) A. Mayer	Dodd 1987
<i>Caloneis bacillum</i> var. <i>fontinalis</i> Hustedt	Stoermer & Kreis 1978
<i>Caloneis bacillum</i> var. <i>lancettula</i> (Schulz) Hustedt	Stoermer & Kreis 1978
<i>Caloneis backmanii</i> A. Cleve	Czarnecki & Blinn 1978
<i>Caloneis clevei</i> (Lagasterdt) Cleve	Stoermer & Kreis 1978
<i>Caloneis clevei</i> var. <i>undulata</i> Krasske	Stoermer et al. 1999
<i>Caloneis columbiensis</i> Cleve	Boyer 1927b
<i>Caloneis fasciata</i> (Lagasterdt) Cleve	Boyer 1927b
<i>Caloneis fenzi</i> (Grunow) Patrick	Patrick & Reimer 1966
<i>Caloneis fenzioides</i> Cleve-Euler	Rushforth & Squires 1985
<i>Caloneis fontinalis</i> (Grunow) Kange-Bertalot & Reichardt	Stoermer et al. 1999
<i>Caloneis formosa</i> Gregory	Stoermer & Kreis 1978
<i>Caloneis hebes</i> (Ralfs) Patrick	Patrick & Reimer 1966
<i>Caloneis holstii</i> Cleve	Cleve 1894
<i>Caloneis hulthenii</i> Petersen	Dodd 1987
<i>Caloneis hyalina</i> Hustedt	Stoermer & Kreis 1978
<i>Caloneis lagerstedtii</i> Cholnoky	Dodd 1987
<i>Caloneis lamella</i> Zakrzewski	Collins & Kalinsky 1977
<i>Caloneis lancettula</i> (Schulz) Lange-Bertalot & Witkowski	Stoermer et al. 1999
<i>Caloneis latiuscula</i> var. <i>reimeri</i> Czarnecki & Blinn	Czarnecki 1979
<i>Caloneis lenzii</i> Krasske	Dodd 1987
<i>Caloneis leptosoma</i> (Grunow) Krammer	Stoermer et al. 1999
<i>Caloneis lewisii</i> Patrick	Stoermer & Kreis 1978
<i>Caloneis lewisii</i> var. <i>inflata</i> (Schultze) Patrick	Patrick & Reimer 1966
<i>Caloneis liber</i> (W. Smith) Cleve	Stoermer et al. 1999
<i>Caloneis limosa</i> (Kützing) Patrick	Stoermer & Kreis 1978
<i>Caloneis limosa</i> var. <i>gibberula</i> (Kützing) Grunow	Stoermer et al. 1999
<i>Caloneis limosa</i> var. <i>subinflata</i> Grunow	Stoermer et al. 1999
<i>Caloneis limosa</i> var. <i>undulata</i> Grunow	Stoermer et al. 1999
<i>Caloneis molaris</i> (Grunow) Krammer	Stoermer et al. 1999
<i>Caloneis nubicola</i> (Grunow) Cleve	Stoermer & Kreis 1978

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<i>Caloneis obtusa</i> (W. Smith) Cleve	Boyer 1927b
<i>Caloneis oregonica</i> (Ehrenberg) Patrick	Grimes & Rushforth 1982
<i>Caloneis permagna</i> (Bailey) Cleve	Rushforth & Squires 1985
<i>Caloneis permagna</i> var. <i>lewisiana</i> Boyer	Starrett & Patrick 1952
<i>Caloneis pseudocleveii</i> Chohnoky	Patrick & Reimer 1966
<i>Caloneis pseudoschumanniana</i> (Hustedt) Simonsen	Simonsen 1987
<i>Caloneis pulchra</i> Messik.	Stoermer & Kreis 1978
<i>Caloneis pulchra</i> var. <i>interrupta</i> Gandhi	Stoermer & Kreis 1978
<i>Caloneis salebrastrata</i> Hohn	Patrick & Reimer 1966
<i>Caloneis schumanniana</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Caloneis schumanniana</i> var. <i>biconstricta</i> Grunow	Stoermer & Kreis 1978
<i>Caloneis schumanniana</i> var. <i>biconstricta</i> f. <i>baikalensis</i> Skv.	Johansen et al. 2004
<i>Caloneis schumanniana</i> var. <i>fasciata</i> Hustedt	Grimes & Rushforth 1982
<i>Caloneis schumanniana</i> var. <i>lancettula</i> Hustedt	Stoermer et al. 1999
<i>Caloneis schumanniana</i> var. <i>linearis</i> Hustedt	Grimes & Rushforth 1982
<i>Caloneis silicula</i> (Ehrenberg) Cleve	Stoermer & Kreis 1978
<i>Caloneis silicula</i> var. <i>alpina</i> Cleve	Patrick 1945
<i>Caloneis silicula</i> var. <i>brevistriata</i> O. Müller	Czarnecki & Blinn 1978
<i>Caloneis silicula</i> var. <i>gibberula</i> (Kützing) Cleve	Boyer 1927b
<i>Caloneis silicula</i> var. <i>inflata</i> (Grunow) Cleve	Boyer 1927b
<i>Caloneis silicula</i> var. <i>minuta</i> (Grunow) Cleve	Patrick 1961
<i>Caloneis silicula</i> var. <i>truncatula</i> (Grunow) Meister	Stoermer & Kreis 1978
<i>Caloneis silicula</i> var. <i>limosa</i> Van Landingham	Stoermer et al. 1999
<i>Caloneis silicula</i> var. <i>tumida</i> Hustedt	Czarnecki & Blinn 1978
<i>Caloneis silicula</i> var. <i>undulata</i> (Grunow) Cleve	Stoermer et al. 1999
<i>Caloneis silicula</i> var. <i>ventricosa</i>	Patrick 1968
<i>Caloneis speciosa</i> (Hustedt) Boyer	Boyer 1927b
<i>Caloneis tenuis</i> (Gregory) Krammer	Stoermer et al. 1999
<i>Caloneis trinodis</i> (Lewis) Boyer	Boyer 1927b
<i>Caloneis trinodis</i> var. <i>inflata</i> Schultze	Patrick & Reimer 1966
<i>Caloneis undosa</i> Krammer	Camburn & Charles 2000
<i>Caloneis undulata</i> (Gregory) Krammer	Stoermer et al. 1999
<i>Caloneis ventricosa</i> (Ehrenberg) Meister	Stoermer & Kreis 1978
<i>Caloneis ventricosa</i> var. <i>alpina</i> Patrick	Collins & Kalinsky 1977
<i>Caloneis ventricosa</i> var. <i>inflata</i>	Collins & Kalinsky 1977
<i>Caloneis ventricosa</i> var. <i>minuta</i> (Grunow) Patrick	Stoermer & Kreis 1978
<i>Caloneis ventricosa</i> var. <i>truncatula</i> (Grunow) Meister	Stoermer & Kreis 1978
<i>Caloneis ventricosa</i> var. <i>subundulata</i> (Grunow) Patrick	Patrick & Reimer 1966
<i>Caloneis westii</i> (W. Smith) Hendey	Kaczmarek & Rushforth 1983
<i>Caloneis zachariasii</i> Reichelt	Prescott & Dillard 1979
<i>Campylodiscus alaeus</i> Setty	Rushforth & Merkley 1988
<i>Campylodiscus americanus</i>	Ehrenberg 1856
<i>Campylodiscus bicostatus</i> W. Smith	Elmore 1922
<i>Campylodiscus clypeus</i> Ehrenberg	Stoermer et al. 1999
<i>Campylodiscus costatus</i> W. Smith	Tempère & Peragallo 1909
<i>Campylodiscus cribrus</i> W. Smith	Stoermer & Kreis 1978
<i>Campylodiscus decorus</i> Brébisson	Stoermer & Kreis 1978
<i>Campylodiscus echensis</i> Ehrenberg	Stoermer et al. 1999
<i>Campylodiscus ehrenbergii</i> Ralfs	Rushforth & Merkley 1988
<i>Campylodiscus eiowanus</i>	Ehrenberg 1856
<i>Campylodiscus hibernicus</i> Ehrenberg	Stoermer & Kreis 1978
<i>Campylodiscus noricus</i> Ehrenberg	Stoermer & Kreis 1978
<i>Campylodiscus noricus</i> var. <i>hibernica</i> (Ehrenberg) Grunow	Stoermer & Kreis 1978
<i>Campylodiscus spiralis</i>	Myers 1898
<i>Capartogramma crucicula</i> (Grunow) Ross	Stoermer & Kreis 1978

Name	Publication
<i>Catacombus gaillonii</i> (Bory) Williams & Round	Stoermer et al. 1999
<i>Cavinula cocconeiformis</i> (Gregory ex Greville) D.G. Mann & Stickle in Round et al.	Stoermer et al. 1999
<i>Cavinula intractata</i> (Hustedt) Lange-Bertalot	Stoermer et al. 1999
<i>Cavinula jaernefeltii</i> (Hustedt) D.G. Mann & Stickle in Round et al.	Stoermer et al. 1999
<i>Cavinula lacustris</i> (Gregory) D.G. Mann & Stickle in Round et al.	Stoermer et al. 1999
<i>Cavinula pseudoscutiformis</i> (Hustedt) D.G. Mann & Stickle in Round et al.	Stoermer et al. 1999
<i>Cavinula scutelloides</i> (W. Smith) Lange-Bertalot	Stoermer et al. 1999
<i>Cavinula scutiformis</i> (Grunow ex A. Schmidt) D.G. Mann & Stickle in Round et al.	Stoermer et al. 1999
<i>Cavinula variostrata</i> (Krasske) D.G. Mann & Stickle in Round et al.	Stoermer et al. 1999
<i>Ceratoneis arcus</i> Kützing	Stoermer & Kreis 1978
<i>Ceratoneis arcus</i> var. <i>amphioxys</i> (Rabenhorst) Grunow	Stoermer & Kreis 1978
<i>Ceratoneis fasciolata</i>	Ehrenberg 1856
<i>Chamaepinnularia begeri</i> (Krasske) Lange-Bertalot	Stoermer et al. 1999
<i>Chamaepinnularia bremensis</i> (Hustedt) Lange-Bertalot in Lange-Bertalot & Metzeltin	Siver et al. 2005
<i>Chamaepinnularia evanida</i> Lange-Bertalot	Stoermer et al. 1999
<i>Chamaepinnularia margaritacea</i> (Hustedt) Lange-Bertalot	Johansen et al. 2004
<i>Chamaepinnularia mediocris</i> (Krasske) Lange-Bertalot	Stoermer et al. 1999
<i>Chamaepinnularia soehrensensis</i> (Krasske) Lange-Bertalot	Stoermer et al. 1999
<i>Chamaepinnularia soehrensensis</i> var. <i>hassiacca</i> (Krasske) Lange-Bertalot	Johansen et al. 2004
<i>Chaetoceras amanita</i> A. Cleve	Kaczmarek & Rushforth 1983
<i>Chaetoceras elmorei</i> Boyer	Boyer 1927a
<i>Chaetoceros hohnii</i> Graebner & Wujek	Stoermer et al. 1999
<i>Chaetoceros muelleri</i> Lemmermann	Kociolek & Herbst 1992
<i>Chaetoceros muelleri</i> var. <i>subsalsum</i> (Lemmermann) Johansen & Rushforth	Rushforth & Johansen 1986
<i>Cocconeis americana</i>	Ehrenberg 1856
<i>Cocconeis amygdalina</i> (Brébisson) Grunow	Patrick & Reimer 1966
<i>Cocconeis borealis</i>	Ehrenberg 1856
<i>Cocconeis decussata</i>	Ehrenberg 1856
<i>Cocconeis delalineata</i> Hohn	Patrick & Reimer 1966
<i>Cocconeis delapunctata</i> Hohn	Patrick & Reimer 1966
<i>Cocconeis diminuta</i> Pantocsek	Stoermer & Kreis 1978
<i>Cocconeis diminuta</i> var. <i>aegagropilae</i> Murobase	Stoermer et al. 1999
<i>Cocconeis diruptoides</i> Hustedt	Stoermer & Kreis 1978
<i>Cocconeis distans</i> Gregory	Patrick & Reimer 1966
<i>Cocconeis disculus</i> (Schumann) Cleve	Stoermer & Kreis 1978
<i>Cocconeis disculus</i> var. <i>diminuta</i> (Pantocsek) A. Cleve	Stoermer & Kreis 1978
<i>Cocconeis elongata</i>	Ehrenberg 1856
<i>Cocconeis euglypta</i> Ehrenberg	Ehrenberg 1856
<i>Cocconeis finnica</i> Ehrenberg	Rushforth & Merkley 1988
<i>Cocconeis flexella</i> (Kützing) Cleve	Stoermer & Kreis 1978
<i>Cocconeis fluviatilis</i> Wallace	Stoermer & Kreis 1978
<i>Cocconeis inusitatus</i> Hohn	Patrick & Reimer 1966
<i>Cocconeis japonica</i> A. Schmidt	Rushforth & Squires 1985
<i>Cocconeis klamathensis</i> Sovereign	Sovereign 1958
<i>Cocconeis limbata</i> Ehrenberg	Patrick & Reimer 1966
<i>Cocconeis lineata</i> Ehrenberg	Stoermer & Kreis 1978
<i>Cocconeis mexicana</i> Ehrenberg	Ehrenberg 1856
<i>Cocconeis mexicana</i>	Ehrenberg 1856
<i>Cocconeis mormonorum</i> Ehrenberg	Patrick & Reimer 1966
<i>Cocconeis neodiminuta</i> Krammer	Stoermer et al. 1999
<i>Cocconeis oblonga</i> Kützing	Patrick & Reimer 1966
<i>Cocconeis patrickiae</i> Reimer	Patrick & Reimer 1966

Name	Publication
<i>Cocconeis pellucida</i> Hantzsch	Patrick & Reimer 1966
<i>Cocconeis pediculus</i> Ehrenberg	Stoermer & Kreis 1978
<i>Cocconeis pinnata</i> Gregory	Patrick & Reimer 1966
<i>Cocconeis placentula</i> Ehrenberg	Stoermer & Kreis 1978
<i>Cocconeis placentula</i> var. <i>euglypta</i> (Ehrenberg) Cleve	Stoermer & Kreis 1978
<i>Cocconeis placentula</i> var. <i>intermedia</i> (Héribaud & Peragallo) Cleve	Collins & Kalinsky 1977
<i>Cocconeis placentula</i> var. <i>klinoraphis</i> Geitler	Stoermer et al. 1999
<i>Cocconeis placentula</i> var. <i>lineata</i> (Ehrenberg) Van Heurck	Stoermer & Kreis 1978
<i>Cocconeis placentula</i> var. <i>rouxii</i> (Héribaud & Brun) Cleve	Stoermer et al. 1999
<i>Cocconeis praetexta</i> Ehrenberg	Patrick & Reimer 1966
<i>Cocconeis rouxii</i> Héribaud & Brun	Stoermer & Kreis 1978
<i>Cocconeis rhombea</i> Ehrenberg	Stoermer & Kreis 1978
<i>Cocconeis rugosa</i> Sovereign	Patrick & Reimer 1966
<i>Cocconeis scutellum</i> Ehrenberg	Stoermer & Kreis 1978
<i>Cocconeis scutellum</i> var. <i>japonica</i> (A. Schmidt) Skvortzow	Stoermer et al. 1999
<i>Cocconeis scutellum</i> var. <i>parva</i> Grunow	Stoermer & Kreis 1978
<i>Cocconeis scutellum</i> f. <i>parva</i> Grunow in Van Heurck	Patrick & Reimer 1966
<i>Cocconeis silicula</i> (Ehrenberg) Cleve	Kutkuhn 1958
<i>Cocconeis striata</i>	Ehrenberg 1856
<i>Cocconeis thumensis</i> A. Mayer	Stoermer & Kreis 1978
<i>Cocconeis thwaitesii</i> W. Smith	Stoermer & Kreis 1978
<i>Cocconeis transversalis</i> Gregory	Stoermer & Kreis 1978
<i>Cocconeis turgida</i>	Ehrenberg 1856
<i>Cocconeis undulata</i> Ehrenberg	Patrick & Reimer 1966
<i>Cocconema arcus</i> Ehrenberg	Patrick & Reimer 1975
<i>Cocconema asperum</i>	Ehrenberg 1856
<i>Cocconema australicum</i> A. Schmidt	Patrick & Reimer 1975
<i>Cocconema cistula</i> Hemprich	Stoermer & Kreis 1978
<i>Cocconema cistula</i> Ehrenberg	Cleve & Möller 1878
<i>Cocconema cornutum</i> Ehrenberg	Patrick & Reimer 1975
<i>Cocconema cymbiforme</i> (Kützing) Ehrenberg	Rushforth & Squires 1985
<i>Cocconema eurypterum</i>	Ehrenberg 1856
<i>Cocconema excisum</i> Kützing	H.L. Smith 1876–1888 (#81)
<i>Cocconema fusidium</i> Ehrenberg	Stoermer & Kreis 1978
<i>Cocconema gastroides</i> (Kützing) Pell.	Stoermer & Kreis 1978
<i>Cocconema gibbum</i> Ehrenberg	Patrick & Reimer 1975
<i>Cocconema gloeonema</i>	Ehrenberg 1856
<i>Cocconema gracile</i>	Ehrenberg 1856
<i>Cocconema helveticum</i> (Kützing) Grunow	Patrick & Reimer 1975
<i>Cocconema lanceolatum</i> Ehrenberg	Stoermer & Kreis 1978
<i>Cocconema lunula</i>	Ehrenberg 1856
<i>Cocconema mexicana</i>	Ehrenberg 1856
<i>Cocconema parva</i> W. Smith	Stoermer & Kreis 1978
<i>Cocconema scotica</i> W. Smith	Stoermer & Kreis 1978
<i>Cocconema subtile</i>	Ehrenberg 1856
<i>Collectonema lacustre</i> Van Heurck	Stoermer & Kreis 1978
<i>Collectonema minutum</i>	Collins & Kalinsky 1977
<i>Collectonema vulgare</i> Thwaites	Collins & Kalinsky 1977
<i>Coccinodiscus apiculatus</i> Ehrenberg	Rushforth & Merkley 1988
<i>Coccinodiscus argus</i> Ehrenberg	Rushforth & Merkley 1988
<i>Coccinodiscus asteromorphus</i> Ehrenberg	Stoermer & Kreis 1978
<i>Coccinodiscus bodanica</i> Schneider	Prescott & Dillard 1979
<i>Coccinodiscus catenata</i> Brunnthaler	Prescott & Dillard 1979
<i>Coccinodiscus chambonis</i> M. Peragallo & Héribaud	Tempère & Peragallo 1909

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<i>Coscinodiscus curvatus</i> Grunow	Stoermer & Kreis 1978
<i>Coscinodiscus decrescens</i> Grunow	Stoermer & Kreis 1978
<i>Coscinodiscus denarius</i> A. Schmidt	Czarnecki & Blinn 1978
<i>Coscinodiscus lacustris</i> Grunow	Stoermer & Kreis 1978
<i>Coscinodiscus lanceolatum</i> Ehrenberg	Stoermer & Kreis 1978
<i>Coscinodiscus marginatus</i> Ehrenberg	Stoermer & Kreis 1978
<i>Coscinodiscus odontodiscus</i> Grunow	Rushforth & Merkley 1988
<i>Coscinodiscus pygmaeus</i> var. <i>micropunctatus</i> M. Peragallo & Héribaud	Drum 1981
<i>Coscinodiscus radiatus</i> Ehrenberg	Stoermer & Kreis 1978
<i>Coscinodiscus rothii</i> (Ehrenberg) Grunow	Stoermer & Kreis 1978
<i>Coscinodiscus rothii</i> var. <i>subsalsa</i> (Juhl.-Dannf.) Hustedt	Stoermer & Kreis 1978
<i>Coscinodiscus subsalsa</i> Juhl.-Dannf.	Stoermer & Kreis 1978
<i>Coscinodiscus subtilis</i> Ehrenberg	Camburn 1982
<i>Coscinodiscus subtilis</i> var. <i>radiatus</i> Hohn	Hohn 1952
<i>Coscinodiscus tuberculatus</i> Greville	Stoermer & Kreis 1978
<i>Coscinodiscus woodwardii</i>	Tilden 1894–1909 (#367)
<i>Cosmioneis lundstroemii</i> (Cleve in Cleve & Grunow) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Cosmioneis pusilla</i> (W. Smith) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Craspedodiscus coscinodiscus</i> Ehrenberg	Stoermer et al. 1999
<i>Craspedodiscus microdiscus</i> Ehrenberg	Stoermer & Kreis 1978
<i>Craticula accomoda</i> (Hustedt) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Craticula acidoclinata</i> Lange-Bertalot & Metzeltin	Siver et al. 2005
<i>Craticula ambigua</i> (Ehrenberg) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Craticula citrus</i> (Krasske) Reichardt	Potapova & Charles 2003
<i>Craticula cuspidata</i> (Kützing) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Craticula cuspidata</i> var. <i>major</i> (Meister) Czarnecki	Stoermer et al. 1999
<i>Craticula halophilioides</i> (Hustedt) Lange-Bertalot	Siver et al. 2005
<i>Craticula perrotettii</i> Grunow	Lange-Bertalot 2001
<i>Craticula subhalophila</i> (Hustedt) Lange-Bertalot	Stoermer et al. 1999
<i>Craticula vixvisibilis</i> (Hustedt) Lange-Bertalot	Stoermer et al. 1999
<i>Ctenophora pulchella</i> (Ralfs ex Kützing) Williams & Round	Stoermer et al. 1999
<i>Ctenophora pulchella</i> var. <i>lacerata</i>	Stoermer et al. 1999
<i>Ctenophora pulchella</i> var. <i>lanceolata</i> (O'Meara) Bukhtiyarova	Stoermer et al. 1999
<i>Cyclostephanos costalimbus</i> (Kob. & Kob.) Stoermer Håkansson & Theriot	Stoermer et al. 1999
<i>Cyclostephanos delicatus</i> (Genkal) Kling & Håkansson	Håkansson & Kling 1990
<i>Cyclostephanos dubius</i> (Fricke) Round in Theriot et al.	Stoermer et al. 1999
<i>Cyclostephanos invisitatus</i> (Hohn & Hellerman) Theriot Stoermer & Håkansson	Stoermer et al. 1999
<i>Cyclostephanos tholiformis</i> Stoermer et al.	Håkansson & Kling 1990
<i>Cyclotella aliquantula</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Cyclotella americana</i> Fricke	Stoermer et al. 1999
<i>Cyclotella antiqua</i> W. Smith	Stoermer & Kreis 1978
<i>Cyclotella arentii</i> Kolbe	Hamilton et al. 1992
<i>Cyclotella atomus</i> Hustedt	Stoermer & Kreis 1978
<i>Cyclotella berolinensis</i> Ehrenberg	Tilden 1894–1909 (#367)
<i>Cyclotella bodanica</i> Eulenstein	Stoermer & Kreis 1978
<i>Cyclotella bodanica</i> var. <i>lemanensis</i> O. Müller	Clark & Rushforth 1977
<i>Cyclotella bodanica</i> var. <i>michiganensis</i> Skvortzow 1937	Stoermer & Kreis 1978
<i>Cyclotella bodanica</i> var. <i>stellata</i> Skvortzow 1937	Stoermer & Kreis 1978
<i>Cyclotella caspia</i> Grunow	Stoermer & Kreis 1978
<i>Cyclotella catenata</i> Brun	Stoermer & Kreis 1978
<i>Cyclotella chaetoceras</i> Lemmermann	Stoermer & Kreis 1978

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<i>Cyclotella choctawhatcheeana</i> Prasad	Carvalho et al. 1995
<i>Cyclotella comensis</i> Grunow	Stoermer & Kreis 1978
<i>Cyclotella comta</i> (Ehrenberg) Kützing	Stoermer & Kreis 1978
<i>Cyclotella comta</i> var. <i>bodanica</i> Grunow	Stoermer & Kreis 1978
<i>Cyclotella comta</i> var. <i>glabriuscula</i> Grunow	Stoermer & Kreis 1978
<i>Cyclotella comta</i> var. <i>oligactis</i> (Ehrenberg) Grunow	Stoermer & Kreis 1978
<i>Cyclotella comta</i> var. <i>paucipunctata</i> Grunow	Stoermer & Kreis 1978
<i>Cyclotella comta</i> var. <i>radiosa</i> Grunow	Patrick 1945
<i>Cyclotella cryptica</i> Reimann et al.	Stoermer & Kreis 1978
<i>Cyclotella cyclopunctata</i> Håkansson & Carter	Stoermer et al. 1999
<i>Cyclotella delicatula</i> Hustedt	Stoermer et al. 1999
<i>Cyclotella distinguenda</i> Hustedt	Stoermer et al. 1999
<i>Cyclotella distinguenda</i> var. <i>unipunctata</i> (Hustedt) Håkansson	Stoermer et al. 1999
<i>Cyclotella dubia</i> Hilse	Stoermer & Kreis 1978
<i>Cyclotella facetia</i> Hohn & Hellerman	Stoermer & Kreis 1978
<i>Cyclotella florida</i> Voigt	Patrick 1968
<i>Cyclotella gamma</i> Sovereign	Sovereign 1963
<i>Cyclotella glomerata</i> Bachmann	Stoermer & Kreis 1978
<i>Cyclotella krammeri</i> Håkansson	Stoermer et al. 1999
<i>Cyclotella kuetzingiana</i> Thwaites	Stoermer & Kreis 1978
<i>Cyclotella kuetzingiana</i> var. <i>planetophora</i> Fricke	Stoermer & Kreis 1978
<i>Cyclotella kuetzingiana</i> var. <i>radiosa</i> Fricke	Stoermer & Kreis 1978
<i>Cyclotella kuetzingiana</i> var. <i>schumannii</i> Grunow	Gaufin et al. 1976
<i>Cyclotella melosiroides</i> (Kirchner) Lemmermann	Stoermer & Kreis 1978
<i>Cyclotella meneghiniana</i> Kützing	Stoermer & Kreis 1978
<i>Cyclotella meneghiniana</i> var. <i>plana</i> Fricke	Stoermer & Kreis 1978
<i>Cyclotella meneghiniana</i> var. <i>pumila</i> (Grunow ex Van Heurck) Hustedt	Grimes & Rushforth 1982
<i>Cyclotella meneghiniana</i> var. <i>rectangulata</i>	Patrick 1945
<i>Cyclotella meneghiniana</i> var. <i>stelligera</i> Cleve & Grunow in Cleve	Boyer 1927a
<i>Cyclotella meneghiniana</i> var. <i>stellulifera</i> Cleve & Grunow	Stoermer & Kreis 1978
<i>Cyclotella michiganiana</i> Skvortzow 1937	Stoermer & Kreis 1978
<i>Cyclotella minutula</i> Arnott	H.L. Smith 1876–1888 (#107)
<i>Cyclotella nana</i> Hustedt	Stoermer & Kreis 1978
<i>Cyclotella ocellata</i> Pantocsek	Stoermer & Kreis 1978
<i>Cyclotella operculata</i> (Agardh) Kützing	Stoermer & Kreis 1978
<i>Cyclotella operculata</i> W. Smith	H.L. Smith 1876–1888 (#107)
<i>Cyclotella operculata</i> var. <i>unipunctata</i> (Fricke) Hustedt	Stoermer et al. 1999
<i>Cyclotella oregonica</i> H.L. Smith	H.L. Smith 1876–1888 (#504)
<i>Cyclotella perforata</i> M. Peragallo	Tempère & Peragallo 1909
<i>Cyclotella planktonica</i> Brunnthaler	Stoermer & Kreis 1978
<i>Cyclotella pseudostelligera</i> Hustedt	Stoermer & Kreis 1978
<i>Cyclotella pseudosteolligera</i> f. <i>parva</i> Czarnecki & Blinn	Czarnecki 1979
<i>Cyclotella quadriiunta</i> (Schroeter) Hustedt	Stoermer & Kreis 1978
<i>Cyclotella radiosa</i> Grunow	Stoermer et al. 1999
<i>Cyclotella rossii</i> Håkansson	Stoermer et al. 1999
<i>Cyclotella rotula</i> Kützing	Stoermer & Kreis 1978
<i>Cyclotella seratula</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Cyclotella socialis</i> Schutt	Stoermer et al. 1999
<i>Cyclotella spinosa</i> Schumann	Stoermer & Kreis 1978
<i>Cyclotella stelligera</i> (Cleve & Grunow) Van Heurck	Stoermer & Kreis 1978
<i>Cyclotella stelligera</i> var. <i>tenuis</i> Hustedt	Dodd 1987
<i>Cyclotella striata</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Cyclotella striata</i> var. <i>ambigua</i> Grunow	Collins & Kalinsky 1977
<i>Cyclotella striata</i> var. <i>bipunctata</i> Fricke	Stoermer & Kreis 1978
<i>Cyclotella striata</i> var. <i>mesoleia</i>	Tempère & Peragallo 1913
<i>Cyclotella temperei</i> M. Peragallo & Héribaud	Stoermer & Kreis 1978
<i>Cyclotella terryana</i> Tempère & Peragallo	Tempère & Peragallo 1909

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<i>Cyclotella thienemannii</i> var. <i>minuscule</i> Jurilj	Stoermer et al. 1999
<i>Cyclotella wolterecki</i> Hustedt	Stoermer & Kreis 1978
<i>Cyclotubicoalister undatus</i> Stoermer et al.	Stoermer et al. 1990
<i>Cylindrotheca gracilis</i> (Brébisson ex Kützing) Grunow	Camburn 1982
<i>Cymatopleura angulata</i> Greville	Stoermer & Kreis 1978
<i>Cymatopleura apiculata</i> W. Smith	Stoermer & Kreis 1978
<i>Cymatopleura campylo-discus</i> J.W. Bailey	H.L. Smith 1876–1888 (#641)
<i>Cymatopleura cochlea</i> Brun	Stoermer & Kreis 1978
<i>Cymatopleura elliptica</i> (Brébisson & Godey) W. Smith	Stoermer & Kreis 1978
<i>Cymatopleura elliptica</i> var. <i>constricta</i> Grunow	Rushforth & Squires 1985
<i>Cymatopleura elliptica</i> var. <i>hibernica</i> (W. Smith) Van Heurck	Stoermer & Kreis 1978
<i>Cymatopleura elliptica</i> var. <i>nobilis</i> (Hantzsch) Hustedt	Dodd 1987
<i>Cymatopleura elliptica</i> f. <i>spiralis</i> Boyer	Stoermer & Kreis 1978
<i>Cymatopleura hibernica</i> W. Smith	Stoermer & Kreis 1978
<i>Cymatopleura hibernica</i> var. <i>rhombica</i> H.H. Chase	Stoermer & Kreis 1978
<i>Cymatopleura librile</i> (Ehrenberg) Pantocsek	Camburn 1982
<i>Cymatopleura mannii</i> M. Peragallo in Tempère & Peragallo	Tempère & Peragallo 1909
<i>Cymatopleura solea</i> (Brébisson & Godey) W. Smith	Stoermer & Kreis 1978
<i>Cymatopleura solea</i> var. <i>apiculata</i> (W. Smith) Ralfs	Stoermer & Kreis 1978
<i>Cymatopleura solea</i> var. <i>clavata</i> O. Müller	Stoermer & Kreis 1978
<i>Cymatopleura solea</i> var. <i>gracilis</i> Grunow	Stoermer et al. 1999
<i>Cymatopleura solea</i> var. <i>palffyi</i> (Pantocsek) Cleve-Euler	Rushforth & Squires 1985
<i>Cymatopleura solea</i> var. <i>pfulhii</i> Torka	Stoermer & Kreis 1978
<i>Cymatopleura solea</i> var. <i>regula</i> (Ehrenberg) Grunow	Stoermer & Kreis 1978
<i>Cymatopleura solea</i> var. <i>subconstricta</i> O. Müller	Stoermer et al. 1999
<i>Cymatopleura solea</i> var. <i>vulgaris</i> Meister	Tiffany & Britton 1952
<i>Cymatopleura spiralis</i> H.H. Chase	Stoermer & Kreis 1978
<i>Cymbella acuta</i> (A. Schmidt) Cleve	Patrick & Reimer 1975
<i>Cymbella acutiuscula</i> Cleve	Stoermer & Kreis 1978
<i>Cymbella aequalis</i> W. Smith	Stoermer & Kreis 1978
<i>Cymbella aequalis</i> var. <i>subaequalis</i> Grunow	Collins & Kalinsky 1977
<i>Cymbella affinis</i> Kützing	Stoermer & Kreis 1978
<i>Cymbella alpestris</i> Krammer	Krammer 2002
<i>Cymbella americana</i> A. Schmidt	Tempère & Peragallo 1908
<i>Cymbella americana</i> f. <i>minor</i>	Van Heurck & Grunow 1882–1885 (#138)
<i>Cymbella amphicephala</i> Nageli	Stoermer & Kreis 1978
<i>Cymbella amphicephala</i> var. <i>subundulata</i> Cleve	Stoermer & Kreis 1978
<i>Cymbella amphioxys</i> (Kützing) Cleve	Bateman & Rushforth 1984
<i>Cymbella anglica</i> Lagerstedt	Stoermer & Kreis 1978
<i>Cymbella angustata</i> (W. Smith) Cleve	Stoermer & Kreis 1978
<i>Cymbella aspera</i> (Ehrenberg) H. Peragallo	Stoermer & Kreis 1978
<i>Cymbella aspera</i> var. <i>minor</i> (Van Heurck) Cleve	Stoermer & Kreis 1978
<i>Cymbella australica</i> (A. Schmidt) Conger	Hohn 1951
<i>Cymbella austriaca</i> Grunow	Stoermer & Kreis 1978
<i>Cymbella bonnevillensis</i> Setty	Rushforth & Merkley 1988
<i>Cymbella borealis</i> Cleve	Camburn & Charles 2000
<i>Cymbella brehmii</i> Hustedt	Stoermer & Kreis 1978
<i>Cymbella buechleri</i> Krammer	Krammer 2002
<i>Cymbella caespitosa</i> Brun	Stoermer & Kreis 1978
<i>Cymbella caespitosum</i> Kützing	Aubert 1895
<i>Cymbella capitata</i> M. Peragallo	Patrick & Reimer 1975
<i>Cymbella cesatii</i> (Rabenhorst) Grunow	Stoermer & Kreis 1978
<i>Cymbella cesatii</i> var. <i>linearis</i> Reimer	Reimer 1961

Name	Publication
<i>Cymbella cistula</i> (Ehrenberg) Kirchner	Stoermer & Kreis 1978
<i>Cymbella cistula</i> var. <i>crassa</i> Tempère & Peragallo	Tempère & Peragallo 1909
<i>Cymbella cistula</i> var. <i>fusidium</i>	Tempère & Peragallo 1909
<i>Cymbella cistula</i> var. <i>gibbosa</i> Brun	Stoermer & Kreis 1978
<i>Cymbella cistula</i> var. <i>gracilis</i> Hustedt	Patrick & Reimer 1975
<i>Cymbella cistula</i> var. <i>maculata</i> (Kützing) Van Heurck	Stoermer & Kreis 1978
<i>Cymbella cistula</i> var. <i>truncata</i> Brun	Stoermer & Kreis 1978
<i>Cymbella clausii</i> Van Landingham	Camburn 1982
<i>Cymbella couleensis</i> Sovereign	Sovereign 1963
<i>Cymbella cucumis</i> var. <i>delicata</i> Tempère & Peragallo	Tempère & Peragallo 1909
<i>Cymbella curta</i> A. Schmidt	Boyer 1927b
<i>Cymbella cuspidata</i> Kützing	Stoermer & Kreis 1978
<i>Cymbella cuspidata</i> var. <i>lanceolata</i> May	Clark & Rushforth 1977
<i>Cymbella cuspidata</i> var. <i>schulzii</i> A. Cleve	Stoermer & Kreis 1978
<i>Cymbella cuspidata</i> f. <i>impressa</i> Fusey	Stoermer et al. 1999
<i>Cymbella cymbiformis</i> Agardh	Stoermer & Kreis 1978
<i>Cymbella cymbiformis</i> var. <i>nonpunctata</i> Fontell	Collins & Kalinsky 1977
<i>Cymbella cymbiformis</i> var. <i>parra</i> (W. Smith) Van Heurck	Myers 1898b
<i>Cymbella delicatula</i> Kützing	Stoermer & Kreis 1978
<i>Cymbella delicatula</i> var. <i>intermedia</i> McCall	Patrick & Reimer 1975
<i>Cymbella descripta</i> (Hustedt) Krammer	Camburn & Charles 2000
<i>Cymbella designata</i> Krammer	Stoermer et al. 1999
<i>Cymbella diluviana</i> (Krasske) Florin	Stoermer & Kreis 1978
<i>Cymbella dissimilis</i> M. Peragallo in Tempère & Peragallo	Tempère & Peragallo 1909
<i>Cymbella dorsirostrata</i> Krammer	Krammer 2002
<i>Cymbella duplopunctata</i> Krammer	Krammer 2002
<i>Cymbella ehrenbergii</i> Kützing	Stoermer & Kreis 1978
<i>Cymbella ehrenbergii</i> var. <i>hungarica</i> Pantocsek	Clark & Rushforth 1977
<i>Cymbella ehrenbergii</i> var. <i>minor</i>	Tempère & Peragallo 1909
<i>Cymbella elizabethana</i> Krammer	Krammer 2002
<i>Cymbella elginsis</i> Krammer	Stoermer et al. 1999
<i>Cymbella excisa</i> Kützing	Boyer 1927b
<i>Cymbella fluminea</i> Patrick & Freese	Patrick & Reimer 1975
<i>Cymbella fonticola</i> Hstedt	Collins & Kalinsky 1977
<i>Cymbella formosa</i> Hustedt	Hustedt 1955
<i>Cymbella gastroides</i> Kützing	Stoermer & Kreis 1978
<i>Cymbella gasteroides</i> (Kützing) Kützing	Rushforth & Merkle 1988
<i>Cymbella gerloffii</i> Van Landingham	Camburn 1982
<i>Cymbella gibba</i> J.W. Bailey	Patrick & Reimer 1975
<i>Cymbella gibberula</i> Hustedt	Krammer 2002
<i>Cymbella gracilis</i> (Rabenhorst) Cleve	Stoermer & Kreis 1978
<i>Cymbella gracilis</i> var. <i>lunata</i> W. Smith	Whitford & Schumacher 1973
<i>Cymbella hauckii</i> Van Heurck	Stoermer & Kreis 1978
<i>Cymbella hebridica</i> Grunow ex Cleve	Stoermer & Kreis 1978
<i>Cymbella helvetica</i> Kützing	Stoermer & Kreis 1978
<i>Cymbella heteropleura</i> (Ehrenberg) Kützing	Boyer 1927b
<i>Cymbella heteropleura</i> var. <i>minor</i> Cleve	Clark & Rushforth 1977
<i>Cymbella heteropleura</i> var. <i>subrostrata</i> Cleve	Patrick & Reimer 1975
<i>Cymbella heteropleura</i> var. <i>symmetrica</i> Boyer	Boyer 1927b
<i>Cymbella hohnii</i> Van Landingham	Camburn 1982
<i>Cymbella hungarica</i> var. <i>grunowii</i> A. Cleve	Clark & Rushforth 1977
<i>Cymbella hustedtii</i> Krasske	Stoermer & Kreis 1978
<i>Cymbella hybrida</i> Grunow	Stoermer & Kreis 1978
<i>Cymbella hybridiformis</i> Hustedt	Patrick & Reimer 1975
<i>Cymbella inaequalis</i> (Ehrenberg) Rabenhorst	Stoermer & Kreis 1978
<i>Cymbella incerta</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Cymbella incerta</i> var. <i>naviculacea</i> Grunow	Johansen et al. 1983

Name	Publication
<i>Cymbella inelegans</i> Cleve.	Patrick & Reimer 1975
<i>Cymbella janischii</i> A. Schmidt	Boyer 1927b
<i>Cymbella javanica</i> Hustedt.	Camburn 1982
<i>Cymbella jordani</i> Grunow	Stoermer & Kreis 1978
<i>Cymbella kappii</i> Cholnoky	Dodd 1987
<i>Cymbella lacustris</i> (Agardh) Cleve.	Boyer 1927b
<i>Cymbella laevis</i> Nageli.	Stoermer & Kreis 1978
<i>Cymbella lanceolata</i> (Agardh) Agardh.	Stoermer & Kreis 1978
<i>Cymbella lanceolata</i> var. <i>cornuta</i> (Ehrenberg) Grunow	Krammer 2002
<i>Cymbella lanceolatum</i> Ehrenberg	Aubert 1895
<i>Cymbella langii</i> MacLaughlin & Andrews	Krammer 2002
<i>Cymbella lata</i> Grunow	Stoermer & Kreis 1978
<i>Cymbella latens</i> Krasske.	Stoermer & Kreis 1978
<i>Cymbella laubyi</i> M. Peragallo & Héribaldi	Tempère & Peragallo 1912
<i>Cymbella leptoceros</i> (Ehrenberg) Rabenhorst	Stoermer & Kreis 1978
<i>Cymbella leptoceros</i> var. <i>angusta</i> Grunow	Boyer 1927b
<i>Cymbella leptoceros</i> var. <i>rostrata</i> Hustedt	Stoermer & Kreis 1978
<i>Cymbella lunata</i> W. Smith	Camburn 1982
<i>Cymbella maculata</i> Kützing	Stoermer & Kreis 1978
<i>Cymbella mexicana</i> (Ehrenberg) Cleve	Stoermer & Kreis 1978
<i>Cymbella mexicana</i> var. <i>janischii</i> (A. Schmidt) Reimer	Patrick & Reimer 1975
<i>Cymbella mexicana</i> var. <i>punctifera</i> Krammer	Krammer 2002
<i>Cymbella microcephala</i> Grunow	Stoermer & Kreis 1978
<i>Cymbella microcephala</i> var. <i>crassa</i> Reimer.	Stoermer et al. 1999
<i>Cymbella minuta</i> Hilse	Stoermer & Kreis 1978
<i>Cymbella minuta</i> var. <i>pseudogracilis</i> (Cholnoky) Reimer.	Stoermer & Kreis 1978
<i>Cymbella minuta</i> var. <i>silesiaca</i> (Bleisch) Reimer.	Stoermer & Kreis 1978
<i>Cymbella minuta</i> f. <i>latens</i> (Krasske) Reimer	Stoermer & Kreis 1978
<i>Cymbella moelleriana</i> Grunow	Stoermer & Kreis 1978
<i>Cymbella muelleri</i> Hustedt.	Stoermer & Kreis 1978
<i>Cymbella muelleri</i> f. <i>ventricosa</i> (Tempère & Peragallo) Reimer.	Stoermer & Kreis 1978
<i>Cymbella naviculiformis</i> Auerswald	Stoermer & Kreis 1978
<i>Cymbella norvegica</i> Grunow	Stoermer & Kreis 1978
<i>Cymbella norvegica</i> f. <i>minor</i> Fusey	Patrick & Reimer 1975
<i>Cymbella obtusa</i> Gregory	Stoermer & Kreis 1978
<i>Cymbella obtusa</i> f. <i>krasskei</i> Foged	Reimer 1961
<i>Cymbella obtusiuscula</i> Kützing	Stoermer & Kreis 1978
<i>Cymbella ornata</i> Hustedt.	Hustedt 1931
<i>Cymbella para</i> (W. Smith) Wolle.	Benson & Rushforth 1975
<i>Cymbella parva</i> (W. Smith) Cleve	Stoermer & Kreis 1978
<i>Cymbella parvula</i> Krasske	Stoermer & Kreis 1978
<i>Cymbella pediculus</i> Kützing.	Stoermer & Kreis 1978
<i>Cymbella perfossilis</i> Krammer	Krammer 2002
<i>Cymbella perpusilla</i> A. Cleve.	Camburn 1982
<i>Cymbella philadelphica</i> Boyer	Boyer 1927b
<i>Cymbella procera</i> Hustedt.	Hustedt 1931
<i>Cymbella producta</i> M. Peragallo	Tempère & Peragallo 1908
<i>Cymbella prostrata</i> (Berkeley) Cleve	Stoermer & Kreis 1978
<i>Cymbella prostrata</i> var. <i>auerswaldii</i> (Rabenhorst) Reimer.	Stoermer & Kreis 1978
<i>Cymbella protracta</i> Østrup.	Rushforth & Squires 1985
<i>Cymbella proxima</i> Reimer	Stoermer & Kreis 1978
<i>Cymbella proxima</i> f. <i>gravida</i> Reimer	Patrick & Reimer 1975
<i>Cymbella pusilla</i> Grunow	Stoermer & Kreis 1978
<i>Cymbella rabenhorstii</i> R. Ross	Stoermer et al. 1999
<i>Cymbella rainierensis</i> Sovereign	Patrick & Reimer 1975
<i>Cymbella reinhardtii</i> Grunow	Patrick & Reimer 1975
<i>Cymbella rhomboidea</i> Boyer	Stoermer & Kreis 1978

Name	Publication
<i>Cymbella robertii</i> Krammer	Krammer 2002
<i>Cymbella rotundata</i> H.H. Chase	Stoermer & Kreis 1978
<i>Cymbella rugosa</i> Hustedt	Stoermer & Kreis 1978
<i>Cymbella rupicola</i> Grunow	Collins & Kalinsky 1977
<i>Cymbella ruttneri</i> Hustedt	Stoermer & Kreis 1978
<i>Cymbella ruttneri</i> var. <i>obtusa</i> Hustedt	Camburn 1982
<i>Cymbella schubartoides</i> Camburn & Charles	Camburn & Charles 2000
<i>Cymbella schmidtii</i> Grunow	Collins & Kalinsky 1977
<i>Cymbella scotica</i> W. Smith	Patrick 1945
<i>Cymbella silesiaca</i> Bleisch	Yearsley et al. 1992
<i>Cymbella similis</i> Krasske	Stoermer & Kreis 1978
<i>Cymbella sinuata</i> Gregory	Stoermer & Kreis 1978
<i>Cymbella sinuata</i> var. <i>antiqua</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Cymbella sinuata</i> var. <i>ovata</i> Hustedt	Stoermer & Kreis 1978
<i>Cymbella sinuata</i> f. <i>antiqua</i> (Grunow) Reimer	Stoermer et al. 1999
<i>Cymbella sinuata</i> f. <i>ovata</i> (Hustedt) Hustedt	Stoermer & Kreis 1978
<i>Cymbella stauroneiformis</i> Lagestedt	Boyer 1927b
<i>Cymbella stoderi</i> Cleve	Boyer 1927b
<i>Cymbella stomatophora</i> Grunow	Stoermer & Kreis 1978
<i>Cymbella subaequalis</i> Grunow	Stoermer & Kreis 1978
<i>Cymbella subaequalis</i> f. <i>krasskei</i> (Foged) Reimer	Stoermer et al. 1999
<i>Cymbella subaspera</i> var. <i>salina</i> Krammer	Krammer 2002
<i>Cymbella subcistula</i> Krammer	Siver et al. 2005
<i>Cymbella subventricosa</i> Cholnoky	Stoermer & Kreis 1978
<i>Cymbella thumensis</i> (A. Mayer) Hustedt	Patrick & Reimer 1975
<i>Cymbella triangulum</i> (Ehrenberg) Cleve	Stoermer & Kreis 1978
<i>Cymbella tumida</i> (Brébisson) Van Heurck	Stoermer & Kreis 1978
<i>Cymbella tumida</i> var. <i>borealis</i> (Grunow) Cleve	Patrick & Reimer 1975
<i>Cymbella tumidula</i> Grunow	Stoermer & Kreis 1978
<i>Cymbella turgida</i> Gregory	Stoermer & Kreis 1978
<i>Cymbella turgida</i> var. <i>pseudogracilis</i> Cholnoky	Stoermer & Kreis 1978
<i>Cymbella turgidula</i> Grunow	Stoermer & Kreis 1978
<i>Cymbella ventricosa</i> Agardh	Stoermer & Kreis 1978
<i>Cymbella ventricosa</i> var. <i>auerswaldii</i> Meister	Hohn & Helleman 1963
<i>Cymbella ventricosa</i> var. <i>girodi</i> (Héribaud) H. Kobayashi	Patrick & Reimer 1975
<i>Cymbella ventricosa</i> var. <i>ovata</i> f. <i>minor</i> Cleve-Euler	Patrick & Reimer 1975
<i>Cymbella ventricosa</i> var. <i>silesiaca</i> (Bleisch) Cleve	Prescott & Dillard 1979
<i>Cymbellonitzschia diluviana</i> Hustedt	Stoermer & Kreis 1978
<i>Cymbopleura acutiuscula</i> (Cleve) Krammer	Krammer 2003
<i>Cymbopleura lata</i> var. <i>americana</i> Krammer	Krammer 2003
<i>Cymbopleura oregonica</i> (Cleve) Krammer	Krammer 2003
<i>Cymbopleura oregonica</i> var. <i>lata</i> Krammer	Krammer 2003
<i>Cymbopleura ornata</i> (Hustedt) Krammer	Krammer 2003
<i>Cymbopleura peroregonica</i> Krammer	Krammer 2003
<i>Cymbopleura procera</i> (Hustedt) Krammer	Krammer 2003
<i>Cymbopleura subrostrata</i> (Cleve) Krammer	Krammer 2003
<i>Cystopleura argus</i> (Kützing) Kuntze	Elmore 1922
<i>Cystopleura gibba</i> (Ehrenberg) Kuntze	Stoermer & Kreis 1978
<i>Cystopleura gibberula</i> (Kützing) Kuntze	Elmore 1922
<i>Cystopleura musculus</i> (Kützing) Kuntze	Elmore 1922
<i>Cystopleura musculus</i> var. <i>constricta</i> (Brébisson) Van Heurck	Elmore 1922
<i>Cystopleura ocellata</i> (Ehrenberg) Kuntze	Elmore 1922
<i>Cystopleura sores</i> (Kützing) Kuntze	Tilden 1894–1909 (#99)
<i>Cystopleura turgida</i> (Ehrenberg) Kuntze	Stoermer & Kreis 1978

Name	Publication
<i>Cystopleura ventricosa</i> (Kützing) Elmore	Elmore 1922
<i>Cystopleura zebra</i> (Ehrenberg) Kuntze	Elmore 1922
<i>Cystopleura zebra</i> var. <i>proboscidea</i> (Kützing) De Toni	Patrick 1945
<i>Cystopleura zebra</i> var. <i>saxonica</i> (Kützing) De Toni	Patrick 1945
<i>Decussata placenta</i> (Ehrenberg) Lange-Bertalot in Metzeltin & Lange-Bertalot	Johansen et al. 2004
<i>Delicata gerloffii</i> (Van Landingham) Krammer	Krammer 2003
<i>Denticula elegans</i> Kützing	Stoermer & Kreis 1978
<i>Denticula elegans</i> var. <i>kittoniana</i> (Grunow) DeToni	Patrick & Reimer 1975
<i>Denticula elegans</i> f. <i>valida</i> Pedicino	Patrick & Reimer 1975
<i>Denticula frigida</i> Kützing	Stoermer & Kreis 1978
<i>Denticula kutzingii</i> Grunow	Camburn & Charles 2000
<i>Denticula lauta</i> J.W. Bailey	Stoermer & Kreis 1978
<i>Denticula palea</i>	Tilden 1894–1909 (#253)
<i>Denticula rainierensis</i> Sovereign	Patrick & Reimer 1975
<i>Denticula splendens</i>	Patrick & Reimer 1975
<i>Denticula subtilis</i> Grunow	Rushforth & Squires 1985
<i>Denticula tenuis</i> Kützing	Stoermer & Kreis 1978
<i>Denticula tenuis</i> var. <i>crassula</i> (Nageli) W. & G.S. West	Stoermer & Kreis 1978
<i>Denticula tenuis</i> f. <i>diminuta</i> Manguin	Dodd 1987
<i>Denticula tenuis</i> var. <i>frigida</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Denticula thermalis</i> Kützing	Stoermer & Kreis 1978
<i>Denticula valida</i> (Pedicino) Grunow in Van Heurck	Tempère & Peragallo 1913
<i>Desmogonium guianense</i> Ehrenberg	Patrick 1946
<i>Desmogonium rabenhorstianum</i> var. <i>elongatum</i> Patrick	Whitford & Schumacher 1973
<i>Diadesmis confervacea</i> Kützing	Stoermer et al. 1999
<i>Diadesmis contenta</i> (Grunow ex Van Heurck) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Diadesmis contenta</i> var. <i>biceps</i> (Grunow in Van Heurck) Hamilton in Hamilton et al.	Hamilton et al. 1992
<i>Diadesmis gallica</i> var. <i>nitzschioides</i> Grunow	Cleve & Möller 1879
<i>Diadesmis peregrina</i> W. Smith	Stoermer et al. 1999
<i>Diadesmis perpusilla</i> (Grunow) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Diatoma anceps</i> (Ehrenberg) Kirchner	Stoermer & Kreis 1978
<i>Diatoma anceps</i> var. <i>capitatum</i> Peragallo in Terry	Boyer 1927a
<i>Diatoma anceps</i> var. <i>constricta</i> Tempère & Peragallo	Tempère & Peragallo 1912
<i>Diatoma anceps</i> var. <i>linearis</i> M. Peragallo	Stoermer & Kreis 1978
<i>Diatoma anceps</i> var. <i>mesodon</i> (Ehrenberg) Grunow in Van Heurck	Hamilton et al. 1992
<i>Diatoma ehrenbergii</i> Kützing	Stoermer & Kreis 1978
<i>Diatoma elongata</i> Agardh	Stoermer & Kreis 1978
<i>Diatoma elongatum</i> (Lyngbye) Agardh	Stoermer & Kreis 1978
<i>Diatoma elongatum</i> var. <i>minor</i> Grunow	Stoermer & Kreis 1978
<i>Diatoma elongatum</i> var. <i>tenuis</i> (Agardh) Van Heurck	Stoermer & Kreis 1978
<i>Diatoma elongatum</i> var. <i>tenuis</i> (Agardh) Van Heurck	Stoermer & Kreis 1978
<i>Diatoma hiemale</i> (Roth) Heiberg	Stoermer & Kreis 1978
<i>Diatoma hiemale</i> var. <i>mesodon</i> (Ehrenberg) Grunow	Stoermer & Kreis 1978
<i>Diatoma hiemale</i> f. <i>curta</i>	Patrick & Reimer 1966
<i>Diatoma mesodon</i> (Ehrenberg) Kützing	Hamilton et al. 1992
<i>Diatoma moniliformis</i> Kützing	Potapova & Charles 2002
<i>Diatoma stellaris</i>	Patrick & Reimer 1966
<i>Diatoma stellata</i>	Patrick & Reimer 1966
<i>Diatoma tenue</i> Agardh	Stoermer & Kreis 1978
<i>Diatoma tenue</i> var. <i>elongatum</i> Lyngbye	Stoermer & Kreis 1978
<i>Diatoma tenue</i> var. <i>pachycephala</i> Grunow	Stoermer & Kreis 1978

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<i>Diatoma vulgare</i> Bory.....	Stoermer & Kreis 1978
<i>Diatoma vulgare</i> var. <i>breve</i> Grunow.....	Patrick & Reimer 1966
<i>Diatoma vulgare</i> var. <i>capitulatum</i> Grunow in Van Heurck.....	Patrick & Reimer 1966
<i>Diatoma vulgare</i> var. <i>ehrenbergii</i> (Kützing) Grunow.....	Stoermer & Kreis 1978
<i>Diatoma vulgare</i> var. <i>grande</i> (W. Smith) Grunow.....	Stoermer & Kreis 1978
<i>Diatoma vulgare</i> var. <i>ovalis</i> (Fricke) Hustedt.....	Stoermer & Kreis 1978
<i>Diatoma vulgare</i> var. <i>pachycephala</i> Grunow.....	Gaufin 1976
<i>Diatoma vulgare</i> var. <i>producta</i> Grunow.....	Stoermer & Kreis 1978
<i>Diatoma vulgare</i> var. <i>linearis</i> Van Heurck.....	Stoermer & Kreis 1978
<i>Diatomella balfouriana</i> Greville.....	Camburn 1982
<i>Didymosphenia geminata</i> (Lyngbye) M. Schmidt.....	Stoermer & Kreis 1978
<i>Diploneis boldtiana</i> Cleve.....	Stoermer & Kreis 1978
<i>Diploneis domblittensis</i> Grunow.....	Stoermer & Kreis 1978
<i>Diploneis elliptica</i> (Kützing) Cleve.....	Stoermer & Kreis 1978
<i>Diploneis elliptica</i> var. <i>ladogensis</i> Cleve.....	Stoermer et al. 1999
<i>Diploneis elliptica</i> var. <i>pygmaea</i> A. Cleve.....	Stoermer & Kreis 1978
<i>Diploneis finnica</i> (Ehrenberg) Cleve.....	Stoermer & Kreis 1978
<i>Diploneis fusca</i> (Gregory) Cleve.....	Johansen et al. 2004
<i>Diploneis fusca</i> var. <i>delicata</i> (A. Schmidt) Cleve.....	Patrick & Reimer 1966
<i>Diploneis interrupta</i> (Kützing) Cleve.....	Stoermer & Kreis 1978
<i>Diploneis marginestriata</i> Hustedt.....	Stoermer & Kreis 1978
<i>Diploneis oblongella</i> (Nageli) Ross.....	Stoermer & Kreis 1978
<i>Diploneis oblongella</i> var. <i>genuina</i> Nageli.....	Stoermer & Kreis 1978
<i>Diploneis ocellata</i> Østrup.....	Stoermer et al. 1999
<i>Diploneis oculata</i> (Brébisson) Cleve.....	Stoermer & Kreis 1978
<i>Diploneis oculata</i> var. <i>linearis</i> Gallik.....	Prescott & Dillard 1979
<i>Diploneis ostracodarum</i> (Pantocsek) Jurilj.....	Patrick & Reimer 1966
<i>Diploneis ovalis</i> (Hilse) Cleve.....	Stoermer & Kreis 1978
<i>Diploneis ovalis</i> var. <i>oblongella</i> (Naegeli) Cleve.....	Hohn 1951
<i>Diploneis papula</i> (A. Schmidt) Cleve.....	Stoermer & Kreis 1978
<i>Diploneis parma</i> Cleve.....	Stoermer & Kreis 1978
<i>Diploneis peterseni</i> Hustedt.....	Stoermer & Kreis 1978
<i>Diploneis pseudovalis</i> Hustedt.....	Stoermer & Kreis 1978
<i>Diploneis puella</i> (Schumann) Cleve.....	Stoermer & Kreis 1978
<i>Diploneis smithii</i> (Brébisson) Cleve.....	Stoermer & Kreis 1978
<i>Diploneis smithii</i> var. <i>dilatata</i> (M. Peragallo) Boyer.....	Camburn 1982
<i>Diploneis smithii</i> var. <i>pumila</i> (Grunow) Hustedt.....	Stoermer & Kreis 1978
<i>Diploneis smithii</i> f. <i>rhombica</i> Mereschkowsky.....	Kaczmarek & Rushforth 1983
<i>Diploneis subovalis</i> Cleve.....	Stoermer & Kreis 1978
<i>Distrionella incognita</i> (Reichardt) Williams.....	Morales et al. 2005
<i>Ellerbeckia arenaria</i> (Moore ex Ralfs) R.M. Crawford.....	Stoermer et al. 1999
<i>Encyonema auerswaldii</i> Rabenhorst.....	Stoermer et al. 1999
<i>Encyonema brehmii</i> (Hustedt) D.G. Mann in Round et al.....	Stoermer et al. 1999
<i>Encyonema caespitosum</i> Kützing.....	Stoermer & Kreis 1978
<i>Encyonema evergladianum</i> Krammer.....	Krammer 1997b
<i>Encyonema formosum</i> (Hustedt) D.G. Mann.....	Krammer 1997a
<i>Encyonema gaeumannii</i> (Meister) Krammer.....	Siver et al. 2005
<i>Encyonema gibbum</i> (J.W. Bailey) Krammer.....	Krammer 1997a
<i>Encyonema gracile</i> Rabenhorst.....	Stoermer & Kreis 1978
<i>Encyonema hebridicum</i> Grunow ex Cleve.....	Krammer 1997b
<i>Encyonema hohnii</i> (Van Landingham) Krammer.....	Krammer 1997b

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<i>Encyonema inelegans</i> (Cleve) Mills	Krammer 1997a
<i>Encyonema lacustre</i> (C. Agardh) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Encyonema latens</i> (Krasske) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Encyonema lunatum</i> (W. Smith) Van Heurck	Krammer 1997a
<i>Encyonema minutum</i> (Hilse ex Rabenhorst) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Encyonema minutum</i> var. <i>pseudogracilis</i> (Cholnoky) Czarnecki	Stoermer et al. 1999
<i>Encyonema muelleri</i> (Hustedt) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Encyonema muelleri</i> f. <i>ventricosa</i> (Tempère & M. Peragallo) Czarnecki	Stoermer et al. 1999
<i>Encyonema neomesianum</i> Krammer	Johansen et al. 2004
<i>Encyonema norvegicum</i> (Grunow) Mills	Krammer 1997b
<i>Encyonema parallelum</i> M. Peragallo in Tempère & Peragallo	Tempère & Peragallo 1909
<i>Encyonema perpusillum</i> (A. Cleve) Mann in Round et al.	Hamilton et al. 1992
<i>Encyonema prostratum</i> Ralfs	Stoermer & Kreis 1978
<i>Encyonema rugosum</i> (Hustedt) D.G. Mann	Krammer 1997a
<i>Encyonema silesiacum</i> (Bleisch ex Rabenhorst) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Encyonema silesiacum</i> var. <i>elegans</i> Krammer	Krammer 1997a
<i>Encyonema temperei</i> Krammer	Krammer 1997b
<i>Encyonema thermale</i> Krammer	Krammer 1997b
<i>Encyonema triangulatum</i> Kützing	Stoermer et al. 1999
<i>Encyonema trianguliforme</i> Krammer	Krammer 1997a
<i>Encyonema triangulum</i> Kützing	Stoermer & Kreis 1978
<i>Encyonema turgidum</i> (Gregory) Grunow	Stoermer & Kreis 1978
<i>Encyonema turgidum</i> var. <i>hebridicum</i>	Cleve & Möller 1879
<i>Encyonema turgidum</i> var. <i>ventricosa</i> Tempère & Peragallo	Tempère & Peragallo 1889–1895
<i>Encyonema ventricosa</i> Kützing	Stoermer & Kreis 1978
<i>Encyonema ventricosum</i> var. <i>angusta</i> Krammer	Siver et al. 2005
<i>Encyonema ventricosum</i> var. <i>stricta</i>	Tempère & Peragallo 1909
<i>Encyonema yellowstonianum</i> Krammer	Krammer 1997a
<i>Encyonopsis cesatii</i> (Rabenhorst) Krammer	Krammer 1997b
<i>Encyonopsis floridana</i> Krammer	Krammer 1997b
<i>Encyonopsis kriegeri</i> var. <i>fossilis</i> Krammer	Krammer 1997b
<i>Encyonopsis microcephala</i> (Grunow) Krammer	Krammer 1997b
<i>Encyonopsis radialis</i> Krammer	Krammer 1997b
<i>Encyonopsis stodderi</i> (Cleve) Krammer	Krammer 1997b
<i>Encyonopsis subminuta</i> Krammer in Reichardt & Krammer	Siver et al. 2005
<i>Encyonopsis subspicula</i> Krammer	Krammer 1997b
<i>Encyonopsis substodderi</i> Krammer	Krammer 1997b
<i>Encyonopsis symmetrica</i> Krammer	Krammer 1997b
<i>Entomoneis alata</i> (Ehrenberg) Ehrenberg	Stoermer et al. 1999
<i>Entomoneis ornata</i> (J.W. Bailey) Reimer	Stoermer & Kreis 1978
<i>Entomoneis paludosa</i> (W. Smith) Reimer	Camburn 1982
<i>Entomoneis paludosa</i> var. <i>duplex</i> (Donkin) Cleve	Kaczmarek & Rushforth 1983
<i>Entomoneis pulchra</i> (J.W. Bailey) Reimer	Patrick & Reimer 1975
<i>Entomoneis robusta</i> (McCall) Reimer	Patrick & Reimer 1975
<i>Epithemia adnata</i> (Kützing) Brébisson	Collins & Kalinsky 1977
<i>Epithemia adnata</i> var. <i>minor</i> (M. Peragallo & Héribaud) Patrick	Stoermer et al. 1999
<i>Epithemia adnata</i> var. <i>porcellus</i> (Kützing) Patrick	Collins & Kalinsky 1977
<i>Epithemia adnata</i> var. <i>proboscidea</i> (Kützing) Patrick	Stoermer et al. 1999
<i>Epithemia adnata</i> var. <i>saxonica</i> (Kützing) Patrick	Stoermer et al. 1999
<i>Epithemia alpestris</i> W. Smith	Stoermer & Kreis 1978
<i>Epithemia amphicephala</i> Grunow	Tempère & Peragallo 1909
<i>Epithemia andrewsii</i> Stoermer & Yang	Stoermer & Kreis 1978
<i>Epithemia argus</i> (Ehrenberg) Kützing	Stoermer & Kreis 1978
<i>Epithemia argus</i> var. <i>alpestris</i> Grunow	Stoermer & Kreis 1978

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<i>Epithemia argus</i> var. <i>amphicephala</i> Grunow	Stoermer & Kreis 1978
<i>Epithemia argus</i> var. <i>longicornis</i> (Ehrenberg) Grunow	Stoermer & Kreis 1978
<i>Epithemia argus</i> var. <i>protracta</i> A. Mayer	Patrick & Reimer 1975
<i>Epithemia emarginata</i> Andrews	Stoermer & Kreis 1978
<i>Epithemia frickei</i> Krammer	Stoermer et al. 1999
<i>Epithemia gibba</i> Kützing	Stoermer & Kreis 1978
<i>Epithemia gibba</i> var. <i>parallela</i> Grunow	Stoermer et al. 1999
<i>Epithemia gibba</i> var. <i>ventricosa</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Epithemia gibberula</i> (Ehrenberg) Kützing	Stoermer & Kreis 1978
<i>Epithemia gibberula</i> var. <i>producta</i> Grunow	Boyer 1927b
<i>Epithemia gibberula</i> var. <i>protracta</i>	Tempère & Peragallo 1913
<i>Epithemia hyndmanii</i> W. Smith	Stoermer & Kreis 1978
<i>Epithemia hyndmanii</i> var. <i>capitata</i> M. Peragallo	Patrick & Reimer 1975
<i>Epithemia hyndmanii</i> var. <i>perlonga</i> Pantocsek	Tempère & Peragallo 1908
<i>Epithemia intermedia</i> Fricke	Stoermer & Kreis 1978
<i>Epithemia muelleri</i> Fricke	Stoermer & Kreis 1978
<i>Epithemia ocellata</i> (Ehrenberg) Kützing	Stoermer & Kreis 1978
<i>Epithemia reicheltii</i> Fricke	Stoermer & Kreis 1978
<i>Epithemia rupestris</i> W. Smith	H.L. Smith 1876–1888 (#152)
<i>Epithemia smithii</i> Carruthers	Stoermer & Kreis 1978
<i>Epithemia sorex</i> Kützing	Stoermer & Kreis 1978
<i>Epithemia truncata</i> M. Peragallo	Patrick & Reimer 1975
<i>Epithemia truncata</i> var. <i>debilis</i> M. Peragallo	Patrick & Reimer 1975
<i>Epithemia turgida</i> (Ehrenberg) Kützing	Stoermer & Kreis 1978
<i>Epithemia turgida</i> var. <i>granulata</i> (Ehrenberg) Brun	Stoermer & Kreis 1978
<i>Epithemia turgida</i> var. <i>plicata</i> Meister	
<i>Epithemia turgida</i> var. <i>vertagus</i>	Tempère & Peragallo 1909
<i>Epithemia turgida</i> var. <i>westermanni</i> (Ehrenberg) Grunow	Stoermer & Kreis 1978
<i>Epithemia turgida</i> var. <i>zebrina</i> (Ehrenberg) Rabenhorst	Stoermer et al. 1999
<i>Epithemia ventricosa</i> Ehrenberg	Stoermer & Kreis 1978
<i>Epithemia westermanni</i> var. <i>stricta</i> Tempère & Peragallo	Tempère & Peragallo 1909
<i>Epithemia zebra</i> (Ehrenberg) Kützing	Stoermer & Kreis 1978
<i>Epithemia zebra</i> f. <i>minor</i>	Tempère & Peragallo 1909
<i>Epithemia zebra</i> var. <i>porcellus</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Epithemia zebra</i> var. <i>proboscida</i> Grunow	Tempère & Peragallo 1908
<i>Epithemia zebra</i> var. <i>saxonica</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Eucoconeis depressa</i> (Cleve) Hustedt	Stoermer & Kreis 1978
<i>Eucoconeis diluviana</i> (Hustedt) Lange-Bertalot	Siver et al. 2005
<i>Eucoconeis flexella</i> (Kützing) Hustedt	Stoermer & Kreis 1978
<i>Eucoconeis flexella</i> var. <i>alpestris</i> (Brun) Hustedt	Stoermer & Kreis 1978
<i>Eucoconeis lapponica</i> Hustedt	Stoermer & Kreis 1978
<i>Eucoconeis lapponica</i> var. <i>ninckei</i> (Guermeur & Manguin) Edlund	Stoermer & Kreis 1978
<i>Eucoconeis minuta</i> (Cleve) Cleve	Stoermer & Kreis 1978
<i>Eunotia aduncus</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Eunotia amphioxys</i> Ehrenberg	Patrick & Reimer 1966
<i>Eunotia arcus</i> Norpel-Schempp & Lange-Bertalot	Stoermer et al. 1999
<i>Eunotia arcus</i> Ehrenberg	Stoermer & Kreis 1978
<i>Eunotia arcus</i> var. <i>bidens</i> Grunow	Stoermer & Kreis 1978
<i>Eunotia arcus</i> var. <i>curta</i> (Grunow) Schonfeldt	Patrick 1945
<i>Eunotia arcus</i> var. <i>fallax</i> Hustedt	Stoermer & Kreis 1978
<i>Eunotia arcus</i> var. <i>plicata</i> (Brun) Héribaud	Patrick & Reimer 1966
<i>Eunotia arcus</i> var. <i>minor</i> Grunow	Boyer 1927a
<i>Eunotia arcus</i> var. <i>tenella</i> Grunow	Tempère & Peragallo 1908
<i>Eunotia arcus</i> var. <i>uncinata</i> (Ehrenberg) Grunow	Patrick & Reimer 1966
<i>Eunotia argus</i>	Ehrenberg 1856

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<i>Eunotia bactriana</i> Ehrenberg	Boyer 1927a
<i>Eunotia batavica</i> f. <i>gamma</i> Berg	Patrick & Reimer 1966
<i>Eunotia biceps</i> Ehrenberg	Boyer 1927a
<i>Eunotia bidens</i> Ehrenberg	Stoermer et al. 1999
<i>Eunotia bidentula</i> W. Smith	Boyer 1927a
<i>Eunotia bidentata</i> W. Smith	Cleve & Möller 1879
<i>Eunotia bigibba</i> Kützing	Lawson & Rushforth 1975
<i>Eunotia bigibba</i> var. <i>pumila</i> Grunow	Camburn 1982
<i>Eunotia bilii</i> Lowe & Kociolek	Lowe & Kociolek 1984
<i>Eunotia bilunaris</i> var. <i>mucophila</i> Lange-Bertalot & Norpel	Dute et al. 2000
<i>Eunotia camelus</i> Ehrenberg	Boyer 1927a
<i>Eunotia camelus</i> f. <i>dentata</i> Berg	Patrick & Reimer 1966
<i>Eunotia carolina</i> Patrick	Patrick 1958
<i>Eunotia catillifera</i> Morrow in Morrow, Deason & Clayton	Morrow et al. 1981
<i>Eunotia cistula</i>	Ehrenberg 1856
<i>Eunotia clavata</i> Hustedt	Hustedt 1913
<i>Eunotia clevei</i> Grunow	Patrick & Reimer 1966
<i>Eunotia collinsii</i> Kalinsky	Kalinsky 1984
<i>Eunotia compacta</i> Hustedt	Hustedt 1913
<i>Eunotia cordillera</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Eunotia cristagalli</i> Cleve	Camburn 1982
<i>Eunotia curvata</i> (Kützing) Lagerstedt	Stoermer & Kreis 1978
<i>Eunotia curvata</i> f. <i>bergii</i> Woodhead & Tweed	Camburn & Charles 2000
<i>Eunotia curvata</i> var. <i>capitata</i> Patrick	Whitford & Schumacher 1973
<i>Eunotia curvata</i> var. <i>falcata</i> (Brébisson) Berg	Clark & Rushforth 1977
<i>Eunotia curvata</i> var. <i>subarcuata</i> (Nageli) Woodhead & Tweed	Camburn 1982
<i>Eunotia cygnus</i> Ehrenberg	Patrick & Reimer 1966
<i>Eunotia denticulata</i> (Brébisson) Rabenhorst	Camburn & Charles 2000
<i>Eunotia depressa</i> Ehrenberg	Patrick & Reimer 1966
<i>Eunotia didyma</i> var. <i>inflata</i> Hustedt	Hustedt 1913
<i>Eunotia diana</i>	Ehrenberg 1856
<i>Eunotia diodon</i> Ehrenberg	Stoermer & Kreis 1978
<i>Eunotia diodon</i> f. <i>minor</i>	Tempère & Peragallo 1908
<i>Eunotia ehrenbergii</i> Ralfs	Boyer 1927a
<i>Eunotia edegans</i> Østrup	Whitford & Schumacher 1973
<i>Eunotia elegans</i> Østrup	Camburn 1982
<i>Eunotia elongata</i> Rabenhorst	Patrick & Reimer 1966
<i>Eunotia euryptera</i>	Ehrenberg 1856
<i>Eunotia exigua</i> (Brébisson) Rabenhorst	Stoermer & Kreis 1978
<i>Eunotia exigua</i> var. <i>bidens</i> Hustedt	Hamilton et al. 1992
<i>Eunotia exigua</i> var. <i>compacta</i> Hustedt	Camburn & Charles 2000
<i>Eunotia exigua</i> var. <i>tridentula</i> Østrup	Camburn & Charles 2000
<i>Eunotia exigua</i> var. <i>undulata</i> Magdeburg	Hamilton et al. 1992
<i>Eunotia faba</i> Ehrenberg emend Van Heurck	Patrick 1945
<i>Eunotia fallax</i> A. Cleve	Camburn 1982
<i>Eunotia fallax</i> var. <i>gracillima</i> Krasske	Camburn 1982
<i>Eunotia fallax</i> var. <i>groenlandica</i> (Grunow) Lange-Bertalot & Norpel	Camburn & Charles 2000
<i>Eunotia flectuosa</i> (Brébisson) Grunow	Hohn & Hellerman 1963
<i>Eunotia flexuosa</i> Brébisson	Stoermer & Kreis 1978
<i>Eunotia flexuosa</i> var. <i>eurycephala</i> Grunow	Stoermer & Kreis 1978
<i>Eunotia formica</i> Ehrenberg	Stoermer & Kreis 1978
<i>Eunotia formica</i> f. <i>alpha</i> Berg	Patrick & Reimer 1966
<i>Eunotia formica</i> f. <i>beta</i> Berg	Patrick & Reimer 1966
<i>Eunotia gibba</i> Ehrenberg	Patrick & Reimer 1966
<i>Eunotia gibberula</i>	Ehrenberg 1856
<i>Eunotia gibbosa</i> Grunow	Boyer 1927a
<i>Eunotia glacialis</i> Meister	Hansmann 1973

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<i>Eunotia gracilis</i> (Ehrenberg) Rabenhorst	Stoermer & Kreis 1978
<i>Eunotia gracilis</i> f. <i>major</i> (M. Peragallo) Héribaud	Patrick & Reimer 1966
<i>Eunotia granulata</i> Ehrenberg	Stoermer & Kreis 1978
<i>Eunotia gratella</i> f. <i>beta</i> Berg	Patrick & Reimer 1966
<i>Eunotia hemicyclus</i> (Ehrenberg) Ralfs	Boyer 1927a
<i>Eunotia hendecaodon</i>	Ehrenberg 1856
<i>Eunotia hexaglyphis</i> Ehrenberg	Patrick 1958
<i>Eunotia hinziae</i> Simonsen 1987	Simonsen 1987
<i>Eunotia hinziae</i> var. <i>diodon</i> Simonsen 1987	Simonsen 1987
<i>Eunotia iatriaensis</i> Foged	Camburn & Charles 2000
<i>Eunotia impressa</i> Ehrenberg	Boyer 1927a
<i>Eunotia incisa</i> W. Smith	Stoermer & Kreis 1978
<i>Eunotia incurvata</i> Hustedt	Hustedt 1913
<i>Eunotia indica</i> Grunow	Patrick 1945
<i>Eunotia inflata</i> (Grunow) Norpel-Schempp & Lange-Bertalot	Stoermer et al. 1999
<i>Eunotia intermedia</i> (Krasske) Norpel-Schempp & Lange-Bertalot	Stoermer et al. 1999
<i>Eunotia kentuccensis</i>	Ehrenberg 1856
<i>Eunotia kocheliensis</i> O. Müller	Patrick & Reimer 1966
<i>Eunotia lapponica</i> Grunow ex A. Cleve	Patrick & Reimer 1966
<i>Eunotia lata</i> Hustedt	Hustedt 1933b
<i>Eunotia librile</i> Ehrenberg	Patrick & Reimer 1966
<i>Eunotia longicornis</i>	Ehrenberg 1856
<i>Eunotia luna</i> Ehrenberg	Boyer 1927a
<i>Eunotia luna</i> var. <i>intermedia</i> Hustedt ex Simonsen 1987	Hustedt 1913
<i>Eunotia luna</i> var. <i>elongata</i> Hustedt ex Simonsen 1987	Hustedt 1913
<i>Eunotia luna</i> var. <i>aequalis</i> Hustedt ex Simonsen 1987	Hustedt 1913
<i>Eunotia luna</i> var. <i>globosa</i> Hustedt ex Simonsen 1987	Hustedt 1913
<i>Eunotia luna</i> var. <i>trapezica</i> Hustedt	Hustedt 1913
<i>Eunotia lunaris</i> (Ehrenberg) Grunow	Stoermer & Kreis 1978
<i>Eunotia lunaris</i> var. <i>attenuata</i> A. Berg	Dixit & Smol 1995
<i>Eunotia lunaris</i> var. <i>capitata</i> Hustedt	Patrick 1945
<i>Eunotia lunaris</i> var. <i>excisa</i> Grunow	Stoermer & Kreis 1978
<i>Eunotia lunaris</i> var. <i>subarcuata</i> (Naegeli) Grunow	Hohn & Hellerman 1963
<i>Eunotia lunula</i> Ehrenberg	Patrick & Reimer 1966
<i>Eunotia major</i> Rabenhorst	Stoermer & Kreis 1978
<i>Eunotia major</i> f. <i>compacta</i> Berg	Patrick & Reimer 1966
<i>Eunotia major</i> f. <i>excelsa</i> Berg	Patrick & Reimer 1966
<i>Eunotia major</i> var. <i>impressa</i> (W. Smith) Rabenhorst	Stoermer & Kreis 1978
<i>Eunotia major</i> f. <i>plectrum</i> Berg	Patrick & Reimer 1966
<i>Eunotia major</i> var. <i>ventricosa</i> A. Cleve	Patrick & Reimer 1966
<i>Eunotia meisteri</i> Hustedt	Camburn 1982
<i>Eunotia meisteri</i> var. <i>bidens</i> Hustedt	Dixit & Smol 1995
<i>Eunotia microcephala</i> Krasske	Stoermer & Kreis 1978
<i>Eunotia microcephala</i> var. <i>tridentata</i> (Mayer) Hustedt	Camburn et al. 1978
<i>Eunotia minor</i> Rabenhorst	Tempère & Peragallo 1908
<i>Eunotia mira</i> var. <i>ovata</i> A. Berg	Bateman & Rushforth 1984
<i>Eunotia monodon</i> Ehrenberg	Stoermer & Kreis 1978
<i>Eunotia monodon</i> f. <i>curta</i>	Tempère & Peragallo 1909
<i>Eunotia monodon</i> var. <i>bidens</i> (Gregory) Hustedt	Scherer 1988
<i>Eunotia monodon</i> var. <i>constricta</i> Cleve-Euler	Whitford & Schumacher 1973
<i>Eunotia monodon</i> var. <i>major</i> (W. Smith) Hustedt	Stoermer & Kreis 1978
<i>Eunotia monodon</i> var. <i>major</i> f. <i>bidens</i> W. Smith	Hohn 1951
<i>Eunotia monodontiforma</i> Lange-Bertalot & Norpel	Stoermer et al. 1999
<i>Eunotia mosis</i> Ehrenberg	Rushforth & Merkley 1988
<i>Eunotia naegelii</i> Migula	Stoermer & Kreis 1978
<i>Eunotia nivalis</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Eunotia nodosa</i> Ehrenberg	Patrick & Reimer 1966

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<i>Eunotia nymanniana</i> Grunow	Boyer 1927a
<i>Eunotia obesa</i> var. <i>wardii</i> Patrick	Patrick 1958
<i>Eunotia paludosa</i> Grunow	Potapova & Charles 2002
<i>Eunotia paludosa</i> var. <i>trinacria</i> (Krasske) Norpel	Camburn & Charles 2000
<i>Eunotia papilio</i> Ehrenberg	Hohn 1951
<i>Eunotia paradoxa</i> Ehrenberg	Patrick & Reimer 1966
<i>Eunotia parallela</i> Ehrenberg	Stoermer & Kreis 1978
<i>Eunotia pectinalis</i> (O. Müller) Rabenhorst	Stoermer & Kreis 1978
<i>Eunotia pectinalis</i> var. <i>biarcuata</i> Berg	Whitford & Schumacher 1973
<i>Eunotia pectinalis</i> f. <i>curta</i>	Tempère & Peragallo 1909
<i>Eunotia pectinalis</i> f. <i>didymodon</i> (Grunow) Berg	Patrick & Reimer 1966
<i>Eunotia pectinalis</i> var. <i>elongatum</i>	Aubert 1895
<i>Eunotia pectinalis</i> var. <i>macilentata</i> Grunow	Van Heurck & Grunow 1882–1885 (#138)
<i>Eunotia pectinalis</i> var. <i>minor</i> (Kützing) Rabenhorst	Stoermer & Kreis 1978
<i>Eunotia pectinalis</i> var. <i>minor</i> f. <i>impressa</i> (Ehrenberg) Hustedt	Patrick 1945
<i>Eunotia pectinalis</i> var. <i>recta</i> Mayer ex Patrick	Patrick 1945
<i>Eunotia pectinalis</i> var. <i>stricta</i> Rabenhorst	Boyer 1927a
<i>Eunotia pectinalis</i> var. <i>soleirolii</i> (Kützing) Boyer	Boyer 1927a
<i>Eunotia pectinalis</i> var. <i>undulata</i> (Ralfs) Rabenhorst	Stoermer & Kreis 1978
<i>Eunotia pectinalis</i> var. <i>ventralis</i> (Ehrenberg) Hustedt	Dodd 1987
<i>Eunotia pectinalis</i> var. <i>ventricosa</i> Grunow	Stoermer & Kreis 1978
<i>Eunotia pectinalis</i> f. <i>minor</i> (Dillwyn) Rabenhorst	Stoermer & Kreis 1978
<i>Eunotia pentaglyphis</i> Ehrenberg	Boyer 1927a
<i>Eunotia perminuta</i> (Grunow) Patrick	Patrick 1958
<i>Eunotia perpusilla</i> Grunow	Stoermer & Kreis 1978
<i>Eunotia pirla</i> Carter & Flower	Carter & Flower 1988
<i>Eunotia pocsinensis</i> Gaiser & Johansen	Gaiser & Johansen 2000
<i>Eunotia polydentula</i> var. <i>perpusilla</i>	Patrick 1968
<i>Eunotia polyglyphis</i> Ehrenberg	Tempère & Peragallo 1913
<i>Eunotia praerupta</i> Ehrenberg	Stoermer & Kreis 1978
<i>Eunotia praerupta</i> var. <i>bidens</i> (Ehrenberg) Grunow	Stoermer & Kreis 1978
<i>Eunotia praerupta</i> var. <i>curta</i> Grunow	Patrick 1945
<i>Eunotia praerupta</i> var. <i>inflata</i> Grunow	Stoermer & Kreis 1978
<i>Eunotia praerupta</i> var. <i>laticeps</i> f. <i>curta</i> Grunow	Stoermer & Kreis 1978
<i>Eunotia praerupta</i> var. <i>monodon</i>	Aubert 1895
<i>Eunotia praerupta</i> var. <i>monodon</i> f. <i>polaris</i> (A. Berg) Symoens	Camburn & Charles 2000
<i>Eunotia praerupta-nana</i> Berg	Patrick & Reimer 1966
<i>Eunotia prionotus</i> Ehrenberg	Patrick & Reimer 1966
<i>Eunotia pseudolunaris</i> Venkt.	Stoermer & Kreis 1978
<i>Eunotia pseudo-parallela</i> f. <i>alpha</i> Berg	Patrick & Reimer 1966
<i>Eunotia punctastriatum</i> Camburn & Charles	Camburn & Charles 2000
<i>Eunotia quarternaria</i> Ehrenberg	Patrick 1958
<i>Eunotia rabenhorstii</i> var. <i>monodon</i> Grunow	Patrick & Reimer 1966
<i>Eunotia recta</i> Hustedt 1913	Hustedt 1913
<i>Eunotia reicheltii</i> Hustedt 1913	Hustedt 1913
<i>Eunotia reicheltii</i> var. <i>bidens</i> Hustedt 1913	Hustedt 1913
<i>Eunotia reicheltii</i> var. <i>triodon</i> Hustedt 1913	Hustedt 1913
<i>Eunotia rhomboidea</i> Hustedt	Camburn 1982
<i>Eunotia robusta</i> Ralfs	Boyer 1927a
<i>Eunotia robusta</i> var. <i>diadema</i>	Patrick & Reimer 1966
<i>Eunotia robusta</i> var. <i>heudecaodon</i> Ralfs	Aubert 1895
<i>Eunotia robusta</i> var. <i>tetraedron</i> (Ehrenberg) Ralfs	Stoermer & Kreis 1978
<i>Eunotia robusta</i> var. <i>triodon</i> Ehrenberg	Aubert 1895
<i>Eunotia rostellata</i> Hustedt ex Patrick	Patrick 1945
<i>Eunotia rostrata</i>	Ehrenberg 1856
<i>Eunotia sarekensis</i> var. <i>pumila</i> (Grunow) S. Berg	Clark & Rushforth 1977
<i>Eunotia schweikerdtii</i> Cholnoky	Camburn et al. 1978

Name	Publication
<i>Eunotia septena</i> Ehrenberg	Patrick 1945
<i>Eunotia septentrionalis</i> Østrup	Stoermer & Kreis 1978
<i>Eunotia serra</i> Ehrenberg	Stoermer & Kreis 1978
<i>Eunotia serra</i> var. <i>diadema</i> (Ehrenberg) Patrick	Camburn 1982
<i>Eunotia serraceniae</i> Gaiser & Johansen	Gaiser & Johansen 2000
<i>Eunotia sima</i> Ehrenberg	Hustedt 1913
<i>Eunotia soleirolii</i> (Kützing) Rabenhorst	Patrick 1958
<i>Eunotia sphaerula</i> Ehrenberg	Patrick & Reimer 1966
<i>Eunotia st.antonii</i>	Ehrenberg 1856
<i>Eunotia stevensonii</i> Boyer	Boyer 1927a
<i>Eunotia submonodon</i> Hustedt 1913	Hustedt 1913
<i>Eunotia sudetica</i> O. Müller	Camburn 1982
<i>Eunotia suecica</i> A. Cleve	Patrick 1945
<i>Eunotia tauntoniensis</i> Hustedt	Boyer 1927a
<i>Eunotia tenella</i> (Grunow) Hustedt	Stoermer & Kreis 1978
<i>Eunotia ternaria</i> Ehrenberg	Patrick & Reimer 1966
<i>Eunotia testudinata</i> Berg	Kalinsky 1979
<i>Eunotia tetraodon</i> Ehrenberg	Boyer 1927a
<i>Eunotia tetraodon</i> f. <i>minuta</i> Berg	Patrick & Reimer 1966
<i>Eunotia torula</i> Hohn	Patrick & Reimer 1966
<i>Eunotia tridentula</i> Ehrenberg	Boyer 1927a
<i>Eunotia tridentula</i> var. <i>perminuta</i> Grunow	Hohn 1951
<i>Eunotia triodon</i> Ehrenberg	Boyer 1927a
<i>Eunotia trinacria</i> Krasske	Stoermer & Kreis 1978
<i>Eunotia trinacria</i> var. <i>undulata</i> Hustedt	Camburn 1982
<i>Eunotia turgida</i>	Ehrenberg 1856
<i>Eunotia uncinata</i> Ehrenberg	Cleve & Möller 1879
<i>Eunotia undulata</i> Ralfs	Tempère & Peragallo 1913
<i>Eunotia valida</i> Hustedt	Stoermer & Kreis 1978
<i>Eunotia vanheurckii</i> Patrick	Stoermer & Kreis 1978
<i>Eunotia vanheurckii</i> var. <i>intermedia</i> (Krasske) Patrick	Stoermer & Kreis 1978
<i>Eunotia varioundulata</i> Norpel & Lange-Bertalot in Lange-Bertalot et al.	Siver et al. 2005
<i>Eunotia veneris</i> (Kützing) De Toni	Boyer 1927a
<i>Eunotia ventralis</i> Ehrenberg	Hohn 1951
<i>Eunotia westermanni</i>	Ehrenberg 1856
<i>Eunotia woleirotii</i> (Kützing) Rabenhorst	Stoermer & Kreis 1978
<i>Eunotia zasuminensis</i> (Cabejszekowna) Korner	Kalinsky 1984
<i>Eunotia zasuminensis</i> var. <i>minor</i> Kalinsky	Kalinsky 1984
<i>Eunotia zebra</i>	Ehrenberg 1856
<i>Eunotia zebrina</i> Ehrenberg	Stoermer & Kreis 1978
<i>Eunotia zygodon</i> Ehrenberg	Boyer 1927a
<i>Eunotia zygodon</i> var. <i>elongata</i> Hustedt	Gaiser & Johansen 2000
<i>Fallacia fracta</i> (Hustedt ex Simonsen) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Fallacia helensis</i> (Schulz) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Fallacia indifferens</i> (Hustedt) D.G. Mann in Round et al.	Johansen et al. 2004
<i>Fallacia insociabilis</i> (Krasske) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Fallacia monoculata</i> (Hustedt) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Fallacia omissa</i> (Hustedt) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Fallacia pseudomuralis</i> (Hustedt) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Fallacia pygmaea</i> (Kützing) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Fallacia subhamulata</i> (Grunow in Van Heurck) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Fallacia submitis</i> (Hustedt) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Fallacia tenera</i> (Hustedt) D.G. Mann	Potapova & Charles 2002
<i>Fallacia vitrea</i> (Østrup) D.G. Mann in Round et al.	Johansen et al. 2004
<i>Fistulifera saphrophila</i> (Lange-Bertalot & Bonik) Lange-Bertalot	Johansen et al. 2004

Name	Publication
<i>Fragilaria acidobionta</i> Charles	Charles 1986
<i>Fragilaria acuta</i> Ehrenberg	Stoermer & Kreis 1978
<i>Fragilaria aequalis</i> Heiberg	Tempère & Peragallo 1909
<i>Fragilaria aequalis</i> var. <i>major</i> Tempère & Peragallo	Tempère & Peragallo 1909
<i>Fragilaria aequalis</i> var. <i>producta</i> Lagerstedt	Tempère & Peragallo 1908
<i>Fragilaria arcus</i> (Ehrenberg) Cleve	Stoermer & Kreis 1978
<i>Fragilaria atomus</i> Hustedt	Stoermer & Kreis 1978
<i>Fragilaria bicapitata</i> A. Mayer	Stoermer & Kreis 1978
<i>Fragilaria biceps</i> Ehrenberg	Patrick & Reimer 1966
<i>Fragilaria bipunctata</i> Ehrenberg	Stoermer & Kreis 1978
<i>Fragilaria bidens</i> Heiberg	Boyer 1927a
<i>Fragilaria bituminosa</i> Pantocsek	Tempère & Peragallo 1913
<i>Fragilaria brevistriata</i> Grunow	Stoermer & Kreis 1978
<i>Fragilaria brevistriata</i> var. <i>binodis</i> (Pantocsek) A. Cleve	Stoermer et al. 1999
<i>Fragilaria brevistriata</i> var. <i>capitata</i> Héribaud	Stoermer & Kreis 1978
<i>Fragilaria brevistriata</i> var. <i>inflata</i> (Pantocsek) Hustedt	Stoermer & Kreis 1978
<i>Fragilaria brevistriata</i> var. <i>inflata</i> f. <i>curta</i> Skvortzow	Reimer 1961
<i>Fragilaria capucina</i> Desm.	Stoermer & Kreis 1978
<i>Fragilaria capucina</i> var. <i>acuta</i> Grunow	Boyer 1927a
<i>Fragilaria capucina</i> var. <i>acuminata</i> Grunow	Boyer 1927a
<i>Fragilaria capucina</i> var. <i>familiaris</i> (Kützing) Hamilton & Siver in Siver et al.	Siver et al. 2005
<i>Fragilaria capucina</i> var. <i>gracilis</i>	Morales 2001
<i>Fragilaria capucina</i> var. <i>lanceolata</i> Grunow	Stoermer & Kreis 1978
<i>Fragilaria capucina</i> var. <i>mesolepta</i> Rabenhorst	Stoermer & Kreis 1978
<i>Fragilaria capucina</i> var. <i>vaucheriae</i> (Kützing) Lange-Bertalot	Kalinsky 1982
<i>Fragilaria constricta</i> Ehrenberg	Hansmann 1973
<i>Fragilaria constricta</i> f. <i>stricta</i> (A. Cleve) Hustedt	Stoermer & Kreis 1978
<i>Fragilaria constricta</i> var. <i>tetranodis</i> (A. Cleve) Hustedt	Hamilton et al. 1992
<i>Fragilaria constricta</i> var. <i>trinodis</i> Hustedt	Hamilton et al. 1992
<i>Fragilaria construens</i> (Ehrenberg) Grunow	Stoermer & Kreis 1978
<i>Fragilaria construens</i> var. <i>bigibba</i> A. Cleve	Stoermer & Kreis 1978
<i>Fragilaria construens</i> var. <i>binodis</i> (Ehrenberg) Grunow	Stoermer & Kreis 1978
<i>Fragilaria construens</i> var. <i>capitata</i> Héribaud	Stoermer & Kreis 1978
<i>Fragilaria construens</i> var. <i>genuina</i>	Tempère & Peragallo 1895
<i>Fragilaria construens</i> var. <i>exigua</i> (W. Smith) Schulz	Patrick & Reimer 1966
<i>Fragilaria construens</i> var. <i>javanica</i> Hustedt	Camburn et al. 1978
<i>Fragilaria construens</i> var. <i>minuta</i> Tempère & Peragallo	Stoermer & Kreis 1978
<i>Fragilaria construens</i> var. <i>pumila</i> Grunow	Stoermer & Kreis 1978
<i>Fragilaria construens</i> var. <i>subsalina</i> Hustedt	Stoermer & Kreis 1978
<i>Fragilaria construens</i> var. <i>venter</i> (Ehrenberg) Grunow	Stoermer & Kreis 1978
<i>Fragilaria construens</i> var. <i>venter</i> f. <i>pusilla</i> Grunow	Clark & Rushforth 1977
<i>Fragilaria crotonensis</i> Kitton	Stoermer & Kreis 1978
<i>Fragilaria crotonensis</i> var. <i>oregona</i> Sovereign	Stoermer & Kreis 1978
<i>Fragilaria crotonensis</i> var. <i>prolongata</i> Grunow	Stoermer & Kreis 1978
<i>Fragilaria cuneata</i> Ehrenberg	Patrick & Reimer 1966
<i>Fragilaria dibolos</i> Hohn & Helleman	Hohn & Helleman 1963
<i>Fragilaria diophthalamia</i> (Ehrenberg) Ehrenberg	Patrick & Reimer 1966
<i>Fragilaria elliptica</i> Schumann	Patrick 1945
<i>Fragilaria elliptica</i> f. <i>minor</i>	Patrick & Reimer 1966
<i>Fragilaria entomon</i> Ehrenberg	Stoermer & Kreis 1978
<i>Fragilaria eugramma</i> Ehrenberg	Patrick & Reimer 1966
<i>Fragilaria exigua</i> Grunow	Camburn & Charles 2000
<i>Fragilaria exiguiformis</i> Lange-Bertalot	Potapova & Charles 2003
<i>Fragilaria floridana</i> Hanna	Hein 1981
<i>Fragilaria glebula</i> Hohn & Helleman	Hohn & Helleman 1963
<i>Fragilaria gnathostoma</i> Hohn	Patrick & Reimer 1966
<i>Fragilaria gracillima</i> A. Mayer	Stoermer & Kreis 1978

Name	Publication
<i>Fragilaria harrisonii</i> Grunow	Stoermer & Kreis 1978
<i>Fragilaria harrisonii</i> var. <i>dubia</i> Grunow	Stoermer & Kreis 1978
<i>Fragilaria harrisonii</i> var. <i>rhomboides</i> Grunow	Stoermer & Kreis 1978
<i>Fragilaria heideni</i> Østrup	Stoermer & Kreis 1978
<i>Fragilaria heideni</i> var. <i>istvanffyi</i> (Pantocsek) Hustedt	Stoermer & Kreis 1978
<i>Fragilaria hungarica</i> Pantocsek	Hamilton et al. 1992
<i>Fragilaria hungarica</i> var. <i>tumida</i> Cleve-Euler	Hamilton et al. 1992
<i>Fragilaria hyemalis</i>	Ehrenberg 1856
<i>Fragilaria incisa</i> (Boyer) Lange-Bertalot	Siver et al. 2005
<i>Fragilaria inflata</i> (Heiden) Hustedt	Stoermer & Kreis 1978
<i>Fragilaria intermedia</i> Grunow	Stoermer & Kreis 1978
<i>Fragilaria intermedia</i> var. <i>continua</i> A. Cleve	Stoermer & Kreis 1978
<i>Fragilaria intermedia</i> var. <i>fallax</i> (Grunow) A. Cleve	Stoermer & Kreis 1978
<i>Fragilaria intermedia</i> var. <i>lanceolata</i> Fusey	Stoermer et al. 1999
<i>Fragilaria interstincta</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Fragilaria javanica</i> Hustedt	Scherer 1988
<i>Fragilaria kriegieriana</i> Krasske	Stoermer & Kreis 1978
<i>Fragilaria lanceolata</i>	Patrick & Reimer 1966
<i>Fragilaria lancettula</i> Schumann	Tempère & Peragallo 1908
<i>Fragilaria lapponica</i> Grunow	Stoermer & Kreis 1978
<i>Fragilaria lapponica</i> var. <i>minuta</i> Cleve	Kaczmarek & Rushforth 1983
<i>Fragilaria lata</i> (Cleve-Euler) Renberg	Hamilton et al. 1992
<i>Fragilaria leptostauron</i> (Ehrenberg) Hustedt	Stoermer & Kreis 1978
<i>Fragilaria leptostauron</i> var. <i>dubia</i> (Grunow) Hustedt	Stoermer & Kreis 1978
<i>Fragilaria leptostauron</i> var. <i>fossilis</i> (Grunow) Rehakova	Stoermer & Kreis 1978
<i>Fragilaria leptostauron</i> var. <i>rhomboides</i> (Grunow) Hustedt	Stoermer & Kreis 1978
<i>Fragilaria levis</i> Ehrenberg	Patrick & Reimer 1966
<i>Fragilaria linearis</i> Castracane	Stoermer & Kreis 1978
<i>Fragilaria marina</i> var. <i>parva</i> Tempère & Peragallo	Tempère & Peragallo 1908
<i>Fragilaria mazamaensis</i> (Sovereign) Lange-Bertalot	Williams & Round 1987
<i>Fragilaria minuscula</i> Grunow	Stoermer & Kreis 1978
<i>Fragilaria mormonorum</i> (Grunow) Boyer (?)	Boyer 1927a
<i>Fragilaria mutabilis</i> Grunow	Stoermer & Kreis 1978
<i>Fragilaria mutabilis</i> var. <i>intercedens</i> W. Smith	Stoermer & Kreis 1978
<i>Fragilaria neoprodacta</i> Lange-Bertalot	Siver et al. 2005
<i>Fragilaria nitida</i> M. Peragallo & Héribaud	Tempère & Peragallo 1913
<i>Fragilaria nitzschioides</i> Grunow	Stoermer & Kreis 1978
<i>Fragilaria oxyptera</i> Ehrenberg	Patrick & Reimer 1966
<i>Fragilaria pantocsekii</i> var. <i>binodis</i> (Pantocsek) A. Cleve	Stoermer & Kreis 1978
<i>Fragilaria paradoxa</i> Ehrenberg	Patrick & Reimer 1966
<i>Fragilaria parasitica</i> (W. Smith) Grunow	Stoermer & Kreis 1978
<i>Fragilaria pectinalis</i>	Ehrenberg 1856
<i>Fragilaria pennsylvanica</i> Morales	Morales 2003
<i>Fragilaria pinnata</i> Ehrenberg	Stoermer & Kreis 1978
<i>Fragilaria pinnata</i> var. <i>acuminata</i> A. Mayer	Camburn & Charles 2000
<i>Fragilaria pinnata</i> var. <i>intercedens</i> (Grunow) Hustedt	Stoermer & Kreis 1978
<i>Fragilaria pinnata</i> var. <i>lancettula</i> (Schumann) Hustedt	Stoermer & Kreis 1978
<i>Fragilaria pinnata</i> var. <i>lancettula</i> f. <i>subcapitata</i> Fusey	Camburn & Charles 2000
<i>Fragilaria pinnata</i> var. <i>subcapitata</i> Frenguelli	Reimer 1966
<i>Fragilaria pinnata</i> var. <i>trigona</i> (Brun & Héribaud) Hustedt	Patrick & Reimer 1966
<i>Fragilaria radians</i> (Kützing) Williams & Round	Stoermer et al. 1999
<i>Fragilaria rhabdosoma</i> Ehrenberg	Patrick & Reimer 1966
<i>Fragilaria rhodana</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Fragilaria robusta</i> Hustedt	Patrick & Reimer 1966
<i>Fragilaria rostrata</i> Ehrenberg	Patrick & Reimer 1966
<i>Fragilaria similis</i> Krasske	Grimes & Rushforth 1982
<i>Fragilaria sinuata</i> M. Peragallo	Patrick & Reimer 1966

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<i>Fragilaria smithiana</i> Grunow in Van Heurck	Patrick & Reimer 1966
<i>Fragilaria socia</i> (Wallace) Lange-Bertalot	Kalinsky 1982
<i>Fragilaria spinosa</i> Skvortzow	Stoermer & Kreis 1978
<i>Fragilaria strangulata</i>	Patrick & Roberts 1979
<i>Fragilaria striolata</i> Ehrenberg	Rushforth & Merkle 1988
<i>Fragilaria sublika</i> Hohn & Helleman	Patrick & Reimer 1966
<i>Fragilaria suboldenburgiana</i> Camburn & Charles	Camburn & Charles 2000
<i>Fragilaria synegrotasca</i> Lange-Bertalot	Lange-Bertalot 1993
<i>Fragilaria tenera</i> (W. Smith) Lange-Bertalot	Kalinsky 1982
<i>Fragilaria turgens</i> Ehrenberg	Patrick & Reimer 1966
<i>Fragilaria ulna</i> (Nitzsch) Lange-Bertalot	Kalinsky 1982
<i>Fragilaria ulna</i> var. <i>amphirhynchus</i> (Ehrenberg) Kalinsky	Kalinsky 1982
<i>Fragilaria ulna</i> var. <i>danica</i> (Kützing) Kalinsky	Kalinsky 1982
<i>Fragilaria undata</i> W. Smith	Boyer 1927a
<i>Fragilaria undata</i> var. <i>lobata</i> Patrick	Patrick 1945
<i>Fragilaria undata</i> var. <i>quadrata</i> Hustedt	Hohn 1951
<i>Fragilaria vaucheriae</i> (Kützing) Peterson	Stoermer & Kreis 1978
<i>Fragilaria vaucheriae</i> var. <i>capitellata</i> (Grunow) Patrick	Stoermer & Kreis 1978
<i>Fragilaria vaucheriae</i> var. <i>continua</i> A. Cleve	Collins & Kalinsky 1977
<i>Fragilaria vaucheriae</i> f. <i>contorta</i> Lowe	Dodd 1987
<i>Fragilaria vaucheria</i> var. <i>distans</i> (Grunow) Boye Petersen	Patrick & Reimer 1966
<i>Fragilaria vaucheriae</i> var. <i>fallax</i> Grunow	Stoermer & Kreis 1978
<i>Fragilaria vaucheriae</i> var. <i>lanceolata</i> A. Mayer	Stoermer & Kreis 1978
<i>Fragilaria vaucheriae</i> var. <i>parvula</i> (Kützing) A. Cleve	Stoermer et al. 1999
<i>Fragilaria vaucheriae</i> var. <i>truncata</i> (Greville) Grunow	Stoermer & Kreis 1978
<i>Fragilaria venter</i>	Ehrenberg 1856
<i>Fragilaria virescens</i> Ralfs	Stoermer & Kreis 1978
<i>Fragilaria virescens</i> var. <i>capitata</i> Østrup	Stoermer & Kreis 1978
<i>Fragilaria virescens</i> var. <i>clavata</i>	Patrick 1968
<i>Fragilaria virescens</i> var. <i>exigua</i> Grunow in Van Heurck	Hamilton et al. 1992
<i>Fragilaria virescens</i> var. <i>mesolepta</i> (Ralfs) Schonfeldt	Stoermer & Kreis 1978
<i>Fragilaria virescens</i> var. <i>nipha</i> Hohn & Helleman	Hohn & Helleman 1963
<i>Fragilaria virescens</i> var. <i>oblongella</i> Grunow	Stoermer & Kreis 1978
<i>Fragilaria virescens</i> var. <i>producta</i> Lagrstedt	Tilden 1894–1909 (#119)
<i>Fragilaria virescens</i> var. <i>subsalina</i> Grunow	Patrick & Reimer 1966
<i>Fragilariforma acidobionta</i> (Charles) Williams & Round	Williams & Round 1987
<i>Fragilariforma bicapitata</i> (Mayer) Williams & Round	Stoermer et al. 1999
<i>Fragilariforma constricta</i> (Ehrenberg) Williams & Round	Stoermer et al. 1999
<i>Fragilariforma constricta</i> f. <i>stricta</i> (A. Cleve) Poulin	Stoermer et al. 1999
<i>Fragilariforma constricta</i> f. <i>tetranodis</i> (A. Cleve) Poulin in Hamilton et al.	Hamilton et al. 1992
<i>Fragilariforma constricta</i> var. <i>trinodis</i> (Hustedt) Hamilton in Hamilton et al.	Hamilton et al. 1992
<i>Fragilariforma hungarica</i> (Pantocsek) Hamilton in Hamilton et al.	Hamilton et al. 1992
<i>Fragilariforma hungarica</i> var. <i>tumida</i> (Cleve-Euler) Hamilton in Hamilton et al.	Hamilton et al. 1992
<i>Fragilariforma lata</i> (Cleve-Euler) Williams & Round	Hamilton et al. 1992
<i>Fragilariforma virescens</i> (Ralfs) Williams & Round	Stoermer et al. 1999
<i>Fragilariforma virescens</i> var. <i>capitata</i> (Østrup) Czarnecki	Stoermer et al. 1999
<i>Fragilariforma virescens</i> var. <i>exigua</i> (Grunow) Poulin in Hamilton et al.	Hamilton et al. 1992
<i>Fragilariforma virescens</i> var. <i>mesolepta</i> (Rabenhorst) Andresen et al.	Andresen et al. 2000
<i>Fragilariforma virescens</i> var. <i>oblongella</i> (Grunow) Andresen et al.	Andresen et al. 2000
<i>Fragilariopsis linearis</i> (Castracane) Hustedt	Stoermer et al. 1999
<i>Frustulia asymmetrica</i> (Cleve) Hustedt	Patrick & Reimer 1966
<i>Frustulia bahlsii</i> Edlund & Brant	Edlund & Brant 1997
<i>Frustulia crassinervia</i> (Brébisson) Lange-Bertalot & Krammer	Potapova & Charles 2003
<i>Frustulia disjuncta</i> Lange-Bertalot	Lange-Bertalot 2001

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<i>Frustulia erifuga</i> Lange-Bertalot & Krammer	Stoermer et al. 1999
<i>Frustulia interposita</i> (Lewis) Cleve	Patrick & Reimer 1966
<i>Frustulia krammeri</i> Lange-Bertalot & Metzeltin in Metzeltin & Lange-Bertalot	Siver et al. 2005
<i>Frustulia longinqua</i> Lange-Bertalot	Lange-Bertalot 2001
<i>Frustulia pelliculosa</i> Brébisson	H.L. Smith 1876-1888 (#171)
<i>Frustulia pseudomagaliesmontana</i> Camburn & Charles	Camburn & Charles 2000
<i>Frustulia rhomboides</i> (Ehrenberg) De Toni	Stoermer & Kreis 1978
<i>Frustulia rhomboides</i> var. <i>amphipleuroides</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Frustulia rhomboides</i> var. <i>capitata</i> (A. Mayer) Patrick	Camburn 1982
<i>Frustulia rhomboides</i> var. <i>crassinervia</i> (Brébisson) Ross	Stoermer & Kreis 1978
<i>Frustulia rhomboides</i> f. <i>occidentalis</i> Sovereign	Patrick & Reimer 1966
<i>Frustulia rhomboides</i> var. <i>saxonica</i> (Rabenhorst) De Toni	Stoermer & Kreis 1978
<i>Frustulia rhomboides</i> var. <i>saxonica</i> f. <i>capitata</i> A. Mayer	Dodd 1987
<i>Frustulia rhomboides</i> var. <i>saxonica</i> f. <i>undulata</i> Hustedt	Dodd 1987
<i>Frustulia rhomboides</i> f. <i>undulata</i> Hustedt	Bateman & Rushforth 1984
<i>Frustulia rhomboides</i> var. <i>viridula</i> (Brébisson) Cleve	Stoermer et al. 1999
<i>Frustulia saxonica</i> Ehrenberg	Stoermer et al. 1999
<i>Frustulia viridula</i> (Brébisson) De Toni	Stoermer & Kreis 1978
<i>Frustulia vulgaris</i> (Thwaites) De Toni	Stoermer & Kreis 1978
<i>Frustulia vulgaris</i> var. <i>capitata</i> Krasske	Stoermer & Kreis 1978
<i>Frustulia weinholdii</i> Hustedt	Stoermer & Kreis 1978
<i>Gallionella aurichalcea</i>	Ehrenberg 1856
<i>Gallionella coarctata</i>	Ehrenberg 1856
<i>Gallionella crenata</i>	Ehrenberg 1856
<i>Gallionella</i> [sic] <i>crotonensis</i>	H.L. Smith 1876-1888 (#678)
<i>Gallionella distans</i> (Ehrenberg)	Stoermer & Kreis 1978
<i>Gallionella granulata</i>	Ehrenberg 1856
<i>Gallionella laevis</i>	Ehrenberg 1856
<i>Gallionella marylandica</i>	Ehrenberg 1856
<i>Gallionella procera</i>	Ehrenberg 1856
<i>Gallionella varians</i>	Ehrenberg 1856
<i>Geissleria acceptata</i> (Hustedt) Lange-Bertalot & Metzeltin	Stoermer et al. 1999
<i>Geissleria aikenensis</i> (Patrick) Torg. & Oliveira	Potapova & Charles 2003
<i>Geissleria declivis</i> (Hustedt) Lange-Bertalot	Stoermer et al. 1999
<i>Geissleria decussis</i> (Østrup) Lange-Bertalot & Metzeltin	Stoermer et al. 1999
<i>Geissleria kriereri</i> (Krasske) Lange-Bertalot	Stoermer et al. 1999
<i>Geissleria paludosa</i> (Hustedt) Lange-Bertalot & Metzeltin	Stoermer et al. 1999
<i>Geissleria schoenfeldii</i> (Hustedt) Lange-Bertalot & Metzeltin	Stoermer et al. 1999
<i>Geissleria similis</i> (Krasske) Lange-Bertalot & Metzeltin	Stoermer et al. 1999
<i>Geissleria tectissima</i> (Lange-Bertalot) Lange-Bertalot	Stoermer et al. 1999
<i>Geissleria thingvallae</i> (Østrup) Metzeltin & Lange-Bertalot	Stoermer et al. 1999
<i>Gloeonema gracile</i>	Ehrenberg 1856
<i>Gloeonema paradoxum</i> Ehrenberg	Stoermer & Kreis 1978
<i>Gloeonema triangulatum</i>	Stoermer & Kreis 1978
<i>Gloeonema virginianum</i>	Ehrenberg 1856
<i>Gomphocymbella ancylus</i> (Cleve) Hustedt	Andresen & Stoermer 1978
<i>Gomphoneis elegans</i> (Grunow) Cleve	Boyer 1927b
<i>Gomphoneis eriense</i> (Grunow) Skvortzow in Skvortzow & Meyer	Stoermer & Kreis 1978
<i>Gomphoneis eriense</i> var. <i>angularis</i> Kociolek & Stoermer	Kociolek & Stoermer 1988
<i>Gomphoneis eriense</i> var. <i>apiculata</i> Stoermer in Reimer	Kociolek & Stoermer 1988
<i>Gomphoneis eriense</i> var. <i>rostrata</i> (M. Schmidt) Skvortzow in Skvortzow & Meyer	Kociolek & Stoermer 1988
<i>Gomphoneis eriense</i> var. <i>variabilis</i> Kociolek & Stoermer	Kociolek & Kingston 1999

Name	Publication
<i>Gomphoneis geitleri</i> Kociolek & Stoermer	Stoermer et al. 1999
<i>Gomphoneis herculeana</i> (Ehrenberg) Cleve	Stoermer & Kreis 1978
<i>Gomphoneis herculeana</i> var. <i>abundans</i> Kociolek & Stoermer	Kociolek & Stoermer 1988
<i>Gomphoneis herculeana</i> var. <i>clavata</i> Cleve	Patrick & Reimer 1975
<i>Gomphoneis herculeana</i> var. <i>loweii</i> Kociolek & Stoermer	Kociolek & Stoermer 1988
<i>Gomphoneis herculeana</i> var. <i>robusta</i> (Grunow) Cleve	Stoermer et al. 1999
<i>Gomphoneis herculeana</i> var. <i>rostrata</i> Tempère & Peragallo	Patrick & Reimer 1975
<i>Gomphoneis herculeana</i> var. <i>septiceps</i> M. Schmidt	Patrick & Reimer 1975
<i>Gomphoneis linearis</i> Kociolek & Stoermer	Kociolek & Stoermer 1986
<i>Gomphoneis mammilla</i> (Ehrenberg) Cleve	Boyer 1927b
<i>Gomphoneis minuta</i> (Stone) Kociolek & Stoermer	Kociolek & Kingston 1999
<i>Gomphoneis olivaceum</i> (Hornemann) Dawson ex Ross & Sims	Camburn 1982
<i>Gomphoneis olivacea</i> var. <i>calcareae</i> (Cleve) Poulin in Poulin et al.	Stoermer et al. 1999
<i>Gomphoneis quadripunctata</i> (Østrup) Dawson ex Ross & Sims	Stoermer et al. 1999
<i>Gomphoneis quadripunctata</i> var. <i>cochleariformis</i> Kociolek & Stoermer	Stoermer et al. 1999
<i>Gomphoneis rostrata</i> (Tempère & Peragallo) Kociolek & Stoermer	Kociolek & Stoermer 1988
<i>Gomphoneis rostrata</i> var. <i>valida</i> Kociolek & Stoermer	Kociolek & Stoermer 1988
<i>Gomphoneis scapha</i> M. Schmidt	Tempère & Peragallo 1909
<i>Gomphoneis septa</i> (Moghadam) Kociolek, Stoermer & Bahls	Kociolek & Stoermer 1986
<i>Gomphoneis subherculeana</i> Kociolek & Stoermer	Kociolek & Stoermer 1988
<i>Gomphoneis trullata</i> Kociolek & Stoermer	Kociolek & Stoermer 1986
<i>Gomphonema abbreviatum</i> Agardh	Stoermer & Kreis 1978
<i>Gomphonema abbreviatum</i> var. <i>inflata</i> Hustedt	Stoermer & Kreis 1978
<i>Gomphonema acuminatum</i> Ehrenberg	Stoermer & Kreis 1978
<i>Gomphonema acuminatum</i> var. <i>brebissonii</i> (Kützing) Cleve	Stoermer & Kreis 1978
<i>Gomphonema acuminatum</i> var. <i>capitatum</i> Mayer	Collins & Kalinsky 1977
<i>Gomphonema acuminatum</i> var. <i>clavus</i> (Brébisson) Grunow	Camburn 1982
<i>Gomphonema acuminatum</i> var. <i>coronatum</i> (Ehrenberg) Rabenhorst	Stoermer & Kreis 1978
<i>Gomphonema acuminatum</i> var. <i>elongatum</i> (W. Smith) Carr	Camburn 1982
<i>Gomphonema acuminatum</i> var. <i>intermedia</i> Grunow	Stoermer & Kreis 1978
<i>Gomphonema acuminatum</i> var. <i>laticeps</i> Ehrenberg	Stoermer & Kreis 1978
<i>Gomphonema acuminatum</i> var. <i>obtusatum</i> (Kützing) Grunow	Johansen et al. 2004
<i>Gomphonema acuminatum</i> var. <i>pusillum</i> Grunow	Stoermer & Kreis 1978
<i>Gomphonema acuminatum</i> var. <i>trigonocephala</i> (Ehrenberg) Grunow	Stoermer & Kreis 1978
<i>Gomphonema acuminatum</i> var. <i>turris</i> Ehrenberg	Stoermer & Kreis 1978
<i>Gomphonema aequale</i> Gregory	Boyer 1927b
<i>Gomphonema affine</i> Kützing	Camburn 1982
<i>Gomphonema affine</i> var. <i>elongatum</i> (Mayer) Millie & Lowe	Stoermer et al. 1999
<i>Gomphonema affine</i> var. <i>insigne</i> (Gregory) Andrews	Stoermer & Kreis 1978
<i>Gomphonema affine</i> f. <i>major</i> Grunow	Hohn & Hellerman 1963
<i>Gomphonema affine</i> var. <i>rhombicum</i> Reichardt	Reichardt 1999
<i>Gomphonema americanum</i> Ehrenberg	Stoermer & Kreis 1978
<i>Gomphonema americobtusatum</i> Reichardt & Lange-Bertalot	Reichardt 1999
<i>Gomphonema angustatum</i> (Kützing) Rabenhorst	Stoermer & Kreis 1978
<i>Gomphonema angustatum</i> var. <i>angustissima</i>	Tempère & Peragallo 1909
<i>Gomphonema angustatum</i> var. <i>citera</i> (Hohn & Hellerman) Patrick	Stoermer et al. 1999
<i>Gomphonema angustatum</i> var. <i>elongata</i> M. Peragallo in Tempère & Peragallo	Tempère & Peragallo 1908
<i>Gomphonema angustatum</i> var. <i>intermedia</i> Grunow	Camburn 1982
<i>Gomphonema angustatum</i> var. <i>linearis</i> Hustedt	Collins & Kalinsky 1977
<i>Gomphonema angustatum</i> var. <i>obesa</i> Lauby	Gaufin et al. 1976
<i>Gomphonema angustatum</i> f. <i>major</i> Van Heurck	Reimer 1970
<i>Gomphonema angustatum</i> var. <i>naviculiformis</i> Mayer	Collins & Kalinsky 1977
<i>Gomphonema angustatum</i> var. <i>obesa</i> Lauby	Patrick 1968
<i>Gomphonema angustatum</i> var. <i>obtusatum</i> (Kützing) Van Heurck	Stoermer & Kreis 1978
<i>Gomphonema angustatum</i> var. <i>productum</i> Grunow	Stoermer & Kreis 1978
<i>Gomphonema angustatum</i> var. <i>sarcophagus</i> (Gregory) Grunow	Stoermer & Kreis 1978

Name	Publication
<i>Gomphonema angustatum</i> var. <i>undulata</i> Grunow	Stoermer & Kreis 1978
<i>Gomphonema angustatum</i> f. <i>undulata</i> Grunow	Stoermer & Kreis 1978
<i>Gomphonema apicatum</i> Ehrenberg	Patrick & Reimer 1975
<i>Gomphonema apiculatum</i> Ehrenberg	Ehrenberg 1843
<i>Gomphonema apuncto</i> Wallace	Kociolek & Kingston 1999
<i>Gomphonema argus</i> Ehrenberg	Patrick & Reimer 1975
<i>Gomphonema augur</i> Ehrenberg	Stoermer & Kreis 1978
<i>Gomphonema augur</i> var. <i>gautieri</i> Van Heurck	Dodd 1987
<i>Gomphonema auritum</i> Braun	Boyer 1927b
<i>Gomphonema bohemicum</i> Reichelt & Fricke	Stoermer & Kreis 1978
<i>Gomphonema brasiliense</i> Grunow	Stoermer & Kreis 1978
<i>Gomphonema brasiliense</i> var. <i>rhombiformis</i>	Patrick & Roberts 1979
<i>Gomphonema brebissonii</i> Kützing	Patrick & Reimer 1975
<i>Gomphonema camburnii</i> Metzeltin & Lange-Bertalot	Camburn & Charles 2000
<i>Gomphonema capitatum</i> Ehrenberg	Stoermer & Kreis 1978
<i>Gomphonema carolinense</i> Hagelstein	Hohn & Hellerman 1963
<i>Gomphonema christensenii</i> Lowe & Kociolek	Lowe & Kociolek 1984
<i>Gomphonema citera</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Gomphonema clavatum</i> Ehrenberg	Patrick & Reimer 1975
<i>Gomphonema clavaherculus</i>	Ehrenberg 1856
<i>Gomphonema clevei</i> Fricke	Stoermer & Kreis 1978
<i>Gomphonema commutatum</i> Grunow	Patrick 1968
<i>Gomphonema commutatum</i> var. <i>subramosum</i>	Patrick & Reimer 1975
<i>Gomphonema consector</i> Hohn & Hellerman	Stoermer & Kreis 1978
<i>Gomphonema constrictum</i> Ehrenberg	Stoermer & Kreis 1978
<i>Gomphonema constrictum</i> var. <i>capitata</i> (Ehrenberg) Van Heurck	Stoermer & Kreis 1978
<i>Gomphonema constrictum</i> f. <i>clavata</i> Cleve-Euler	Clark & Rushforth 1977
<i>Gomphonema constrictum</i> var. <i>cuneata</i> A. Schmidt	Whitford & Schumacher 1973
<i>Gomphonema constrictum</i> var. <i>elongata</i> Héribaud & Peragallo	Stoermer 1964
<i>Gomphonema constrictum</i> var. <i>subcapitatum</i> Van Heurck	Boyer 1927b
<i>Gomphonema coronatum</i> Ehrenberg	Stoermer & Kreis 1978
<i>Gomphonema cristatum</i> Ralfs	H.L. Smith 1876–1888 (#171)
<i>Gomphonema cumrhis</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Gomphonema curvatum</i> Kützing	Stoermer & Kreis 1978
<i>Gomphonema cymbelliclinum</i> Reichardt & Lange-Bertalot	Reichardt 1999
<i>Gomphonema cygnus</i> Ehrenberg	Ehrenberg 1843
<i>Gomphonema dichotomum</i> Kützing	Stoermer & Kreis 1978
<i>Gomphonema elegans</i> Grunow	Rushforth & Merkle 1988
<i>Gomphonema elongatum</i> W. Smith	Tempère & Peragallo 1912
<i>Gomphonema erienne</i> Grunow	Stoermer & Kreis 1978
<i>Gomphonema exiguum</i> Kützing	Elmore 1922
<i>Gomphonema exilissima</i> (Grunow) Lange-Bertalot & Reichardt	Stoermer et al. 1999
<i>Gomphonema freesei</i> Lowe & Kociolek	Lowe & Kociolek 1984
<i>Gomphonema geminata</i> (Lyngbye) Agardh	Stoermer & Kreis 1978
<i>Gomphonema germainii</i> Kociolek & Stoermer	Stoermer et al. 1999
<i>Gomphonema gibba</i> Wallace	Camburn 1982
<i>Gomphonema giganteum</i> Ehrenberg	Ehrenberg 1852
<i>Gomphonema glans</i> Ehrenberg	Patrick & Reimer 1975
<i>Gomphonema globiferum</i> Meister	Patrick & Reimer 1975
<i>Gomphonema gracile</i> Ehrenberg	Stoermer & Kreis 1978
<i>Gomphonema gracile</i> var. <i>auritum</i> (A. Braun) Grunow	Patrick 1945
<i>Gomphonema gracile</i> var. <i>cymbelloides</i> Grunow	Stoermer & Kreis 1978
<i>Gomphonema gracile</i> var. <i>insignis</i> Gregory	Collins & Kalinsky 1977
<i>Gomphonema gracile</i> var. <i>intricatiforme</i> Mayer	Bateman & Rushforth 1984
<i>Gomphonema gracile</i> var. <i>lanceolata</i> (Kützing) Cleve	Collins & Kalinsky 1977
<i>Gomphonema gracile</i> var. <i>dichotoma</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Gomphonema gracile</i> f. <i>major</i> (Grunow) O. Müller	Hohn 1961

Name	Publication
<i>Gomphonema gracile</i> var. <i>naviculacea</i> (W. Smith) Cleve	Stoermer & Kreis 1978
<i>Gomphonema gracile</i> var. <i>naviculoides</i> (W. Smith) Grunow	Patrick 1945
<i>Gomphonema gracile</i> f. <i>parva</i> Van Heurck	Reimer 1970
<i>Gomphonema grovei</i> M. Schmidt	Stoermer & Kreis 1978
<i>Gomphonema grovei</i> var. <i>lingulatum</i> (Hustedt) Lange-Bertalot	Stoermer et al. 1999
<i>Gomphonema grunowii</i> Patrick	Camburn 1982
<i>Gomphonema hedinii</i> Hustedt	Patrick & Reimer 1975
<i>Gomphonema helveticum</i> Brun	Stoermer & Kreis 1978
<i>Gomphonema helveticum</i> var. <i>tenuis</i> Hustedt	Stoermer & Kreis 1978
<i>Gomphonema herculeanum</i> Ehrenberg	Stoermer & Kreis 1978
<i>Gomphonema herculeanum</i> var. <i>robusta</i> Grunow	Stoermer & Kreis 1978
<i>Gomphonema himantaneum</i> Ehrenberg	H.L. Smith 1876–1888 (#563)
<i>Gomphonema hotchkissii</i> Van Landingham	Camburn 1982
<i>Gomphonema innocens</i> Reichardt	Reichardt 1999
<i>Gomphonema insigne</i> Gregory	Collins & Kalinsky 1977
<i>Gomphonema instabilis</i> Hohn & Hellerman	Collins & Kalinsky 1977
<i>Gomphonema intermedium</i> Grunow	Tempère & Peragallo 1909
<i>Gomphonema intricatum</i> Kützing	Stoermer & Kreis 1978
<i>Gomphonema intricatum</i> var. <i>bohemicum</i> (R. & F.) Cleve-Euler	Patrick & Reimer 1975
<i>Gomphonema intricatum</i> f. <i>pusilla</i> Mayer	Collins & Kalinsky 1977
<i>Gomphonema intricatum</i> var. <i>dichotomum</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Gomphonema intricatum</i> var. <i>fossilis</i> Pantocsek	Stoermer & Kreis 1978
<i>Gomphonema intricatum</i> var. <i>pumila</i> Grunow	Stoermer & Kreis 1978
<i>Gomphonema intricatum</i> var. <i>pulvinatum</i> (Braun) Grunow	Camburn 1982
<i>Gomphonema intricatum</i> var. <i>vibrio</i> (Ehrenberg) Cleve	Stoermer & Kreis 1978
<i>Gomphonema intricatum</i> var. <i>vibrio</i> f. <i>subcapitata</i> A. Mayer	Patrick & Reimer 1975
<i>Gomphonema kobayashii</i> Kociolek & Kingston	Kociolek & Kingston 1999
<i>Gomphonema lanceolatum</i> Agardh	Collins & Kalinsky 1977
<i>Gomphonema lanceolatum</i> var. <i>insignis</i> (Gregory) Cleve	Stoermer & Kreis 1978
<i>Gomphonema laticeps</i> Ehrenberg	Stoermer & Kreis 1978
<i>Gomphonema leptocampum</i> Kociolek & Stoermer	Stoermer et al. 1999
<i>Gomphonema linea</i>	Ehrenberg 1856
<i>Gomphonema lingulatiforme</i> Lange-Bertalot & Reichardt	Potapova & Charles 2003
<i>Gomphonema lingulatum</i> Hustedt	Stoermer & Kreis 1978
<i>Gomphonema lingulatum</i> var. <i>constricta</i> Hustedt	Collins & Kalinsky 1977
<i>Gomphonema longiceps</i> Ehrenberg	Stoermer & Kreis 1978
<i>Gomphonema longiceps</i> var. <i>montana</i> (Schumann) Cleve	Stoermer & Kreis 1978
<i>Gomphonema longiceps</i> var. <i>subclavata</i> Grunow	Stoermer & Kreis 1978
<i>Gomphonema longiceps</i> var. <i>subclavata</i> f. <i>gracilis</i> Hustedt	Stoermer & Kreis 1978
<i>Gomphonema longiceps</i> f. <i>gracilis</i> Hustedt	Stoermer & Kreis 1978
<i>Gomphonema longiceps</i> f. <i>suecica</i> Grunow	Hansmann 1973
<i>Gomphonema longicolle</i> Ehrenberg	Patrick & Reimer 1975
<i>Gomphonema louisiananum</i> Kalinsky	Kalinsky 1984
<i>Gomphonema maclaughlinii</i> Reichardt	Reichardt 1999
<i>Gomphonema mammilla</i> Ehrenberg	Ehrenberg 1854
<i>Gomphonema manubrium</i> Fricke	Stoermer & Kreis 1978
<i>Gomphonema mehleri</i> Camburn	Camburn 1982
<i>Gomphonema mexicanum</i> Grunow	Reichardt 1999
<i>Gomphonema micropus</i> Kützing	Tempère & Peragallo 1908
<i>Gomphonema minutissima</i> Greville emend. Ehrenberg	Patrick & Reimer 1975
<i>Gomphonema minutum</i> Agardh	Kociolek & Kingston 1999
<i>Gomphonema montanum</i> Schumann	Stoermer & Kreis 1978
<i>Gomphonema montanum</i> var. <i>acuminatum</i> (Peragallo & Héribaud) A. Mayer	Patrick & Reimer 1975
<i>Gomphonema montanum</i> var. <i>media</i> Grunow	Collins & Kalinsky 1977
<i>Gomphonema montanum</i> var. <i>subclavatum</i> Grunow	Camburn 1982
<i>Gomphonema montanum</i> var. <i>suecica</i> Grunow	Patrick & Reimer 1975
<i>Gomphonema mustela</i> Ehrenberg	Andresen & Stoermer 1978

Name	Publication
<i>Gomphonema mantezumense</i> Czarnecki & Blinn	Czarnecki 1979
<i>Gomphonema nasutum</i> Ehrenberg	Patrick & Reimer 1975
<i>Gomphonema novacula</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Gomphonema obtusum</i>	Ehrenberg 1856
<i>Gomphonema olivaceoides</i> Hustedt	Stoermer & Kreis 1978
<i>Gomphonema olivaceoides</i> var. <i>cochleariformis</i> Manguin	Stoermer & Kreis 1978
<i>Gomphonema olivaceoides</i> var. <i>densestriata</i> Foged	Stoermer & Kreis 1978
<i>Gomphonema olivaceoides</i> var. <i>hutchinsoniana</i> Patrick	Camburn 1982
<i>Gomphonema olivaceum</i> (Lyngbye) Kützing	Stoermer & Kreis 1978
<i>Gomphonema olivaceum</i> var. <i>calcareum</i> (Cleve) Cleve	Stoermer & Kreis 1978
<i>Gomphonema olivaceum</i> var. <i>minutissima</i> Hustedt	Stoermer & Kreis 1978
<i>Gomphonema olivaceum</i> var. <i>olivaceoides</i> (Hustedt) Lange-Bertalot	Stoermer et al. 1999
<i>Gomphonema olivaceum</i> var. <i>tenellum</i> (Kützing) Cleve	Patrick & Reimer 1975
<i>Gomphonema olivaceum</i> var. <i>vulgaris</i> (Kützing) Grunow	Patrick & Reimer 1975
<i>Gomphonema olor</i> Ehrenberg	Ehrenberg 1849
<i>Gomphonema oregonicum</i> Ehrenberg	Tempère & Peragallo 1912
<i>Gomphonema ovatum</i> H.L. Smith	Patrick & Reimer 1975
<i>Gomphonema pachycladum</i> Brebisson	Collins & Kalinsky 1977
<i>Gomphonema pala</i> Reichardt	Siver et al. 2005
<i>Gomphonema parvulum</i> (Kützing) Kützing	Stoermer & Kreis 1978
<i>Gomphonema parvulum</i> var. <i>aequalis</i> A. Mayer	Dodd 1987
<i>Gomphonema parvulum</i> var. <i>subelliptica</i> Cleve	Stoermer & Kreis 1978
<i>Gomphonema parvulum</i> var. <i>exilissima</i> Grunow	Stoermer & Kreis 1978
<i>Gomphonema parvulum</i> var. <i>lagenula</i> (Kützing) Frenguelli	Stoermer & Kreis 1978
<i>Gomphonema parvulum</i> var. <i>micropus</i> (Kützing) Cleve	Stoermer & Kreis 1978
<i>Gomphonema parvulum</i> var. <i>parvulum</i> Lange-Bertalot & Reichardt	Potapova & Charles 2003
<i>Gomphonema parvulum</i> var. <i>subellipticum</i> Cleve	Whitford & Schumacher 1973
<i>Gomphonema patricki</i> Kociolek & Stoermer	Kociolek et al. 1995
<i>Gomphonema productum</i> Lange-Bertalot & Reichardt	Stoermer et al. 1999
<i>Gomphonema pseudoaugur</i> Lange-Bertalot	Stoermer et al. 1999
<i>Gomphonema pseudopusillum</i> Reichardt	Reichardt 1999
<i>Gomphonema pseudotenellum</i> Lange-Bertalot	Stoermer et al. 1999
<i>Gomphonema puiggarianum</i> Grunow	Boyer 1927b
<i>Gomphonema puiggarianum</i> var. <i>aequatorialis</i> Cleve	Camburn 1982
<i>Gomphonema pumilum</i> (Grunow) Reichardt & Lange-Bertalot	Potapova & Charles 2002
<i>Gomphonema pygmaeum</i> Kociolek & Stoermer	Stoermer et al. 1999
<i>Gomphonema quadripunctatum</i> (Østrup) Wislough	Stoermer & Kreis 1978
<i>Gomphonema reimeri</i> (Camburn) Kociolek & Kingston	Kociolek & Kingston 1999
<i>Gomphonema rhombicum</i> Fricke	Camburn 1982
<i>Gomphonema rhombicum</i> f. <i>minor</i> Fricke	Sovereign 1958
<i>Gomphonema robustum</i> Grunow	Stoermer & Kreis 1978
<i>Gomphonema rotundatum</i>	Ehrenberg 1856
<i>Gomphonema sagitta</i> Schumann	Prescott & Dillard 1979
<i>Gomphonema sarcophagus</i> Gregory	Stoermer & Kreis 1978
<i>Gomphonema semiapertum</i> Grunow	Stoermer & Kreis 1978
<i>Gomphonema septata</i> Naegeli	Prescott & Dillard 1979
<i>Gomphonema septum</i> Moghadam	Patrick & Reimer 1975
<i>Gomphonema simus</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Gomphonema sparsistriatum</i> (O. Müller) Engler	Patrick 1968
<i>Gomphonema sparsistriatum</i> f. <i>maculatum</i> Camburn	Camburn 1982
<i>Gomphonema sphaerophorum</i> Ehrenberg	Stoermer & Kreis 1978
<i>Gomphonema sphaerophorum</i> var. <i>turgidum</i> Ehrenberg	Patrick & Reimer 1975
<i>Gomphonema stoermeri</i> (M. Schmidt) Kociolek & Kingston	Kociolek & Kingston 1999
<i>Gomphonema stonei</i> Reichardt	Hohn & Hellerman 1963
<i>Gomphonema subclavata</i> var. <i>mustela</i> (Ehrenberg) Cleve	Stoermer & Kreis 1978
<i>Gomphonema subclavata</i> f. <i>gracilis</i> (Hustedt) Woodhead & Tweed	Stoermer & Kreis 1978
<i>Gomphonema subclavatum</i> (Grunow) Grunow	Stoermer & Kreis 1978

Name	Publication
Gomphonema subclavatum var. commutatum (Grunow) A. Mayer	Patrick & Reimer 1975
Gomphonema subclavatum var. mexicanum (Grunow) Patrick	Camburn 1982
Gomphonema subclavatum var. mustela (Ehrenberg) Cleve	Stoermer et al. 1999
Gomphonema submehleri Kociolek & Stoermer	Stoermer et al. 1999
Gomphonema subtile Ehrenberg	Stoermer & Kreis 1978
Gomphonema subtile f. angusta	Tempère & Peragallo 1913
Gomphonema subtile var. sagitta (Schumann) Cleve	Stoermer & Kreis 1978
Gomphonema subventricosum Hustedt	Camburn 1982
Gomphonema superiorensis Kociolek & Stoermer	Stoermer et al. 1999
Gomphonema tackei var. brevistriatum Camburn	Camburn et al. 1978
Gomphonema tenellum Kützing	Camburn 1982
Gomphonema tergestinum (Grunow) Fricke	Stoermer & Kreis 1978
Gomphonema trigonocephalum Ehrenberg	Stoermer & Kreis 1978
Gomphonema truncatum Ehrenberg	Stoermer & Kreis 1978
Gomphonema truncatum var. capitatum (Ehrenberg) Patrick	Camburn 1982
Gomphonema truncatum var. cuneatum (Fricke) Camburn	Camburn 1982
Gomphonema truncatum var. elongata (Peragallo & Héribaud) Patrick	Patrick & Reimer 1975
Gomphonema truncatum var. macilentum Kociolek & Stoermer	Stoermer et al. 1999
Gomphonema truncatum var. turgidum (Ehrenberg) Patrick	Stoermer et al. 1999
Gomphonema tumens Kociolek & Stoermer	Kociolek & Stoermer 1991
Gomphonema turgidum Grunow	Stoermer & Kreis 1978
Gomphonema turris Ehrenberg	Stoermer & Kreis 1978
Gomphonema turritum	Ehrenberg 1856
Gomphonema validum Cleve	Patrick & Reimer 1975
Gomphonema validum var. elongatum Cleve	Patrick & Reimer 1975
Gomphonema variabilis Jurilj	Patrick & Reimer 1975
Gomphonema variostriatum Camburn & Charles	Camburn & Charles 2000
Gomphonema ventricosum Gregory	Stoermer & Kreis 1978
Gomphonema ventricosum var. maxima Cleve	Patrick & Reimer 1975
Gomphonema vibrio Ehrenberg	Stoermer & Kreis 1978
Gomphonema vibrio var. fossile (Pantocsek) R. Ross	Stoermer et al. 1999
Gomphonema vibrio intricatum (Kützing) R. Ross	Stoermer et al. 1999
Gomphonema vibrio var. pumilum (Grunow in Van Heurck) R. Ross	Stoermer et al. 1999
Gomphonitzschia exigua Sovereign	Sovereign 1958
Gomphosphenia lingulatiformis (Lange-Bertalot & Reichardt) Lange-Bertalot	Kociolek & Kingston 1999
Grammatophora stricta Ehrenberg	Rushforth & Merkley 1988
Grunowia sinuata Rabenhorst	Aubert 1895
Gyrosigma acuminatum (Kützing) Rabenhorst	Stoermer & Kreis 1978
Gyrosigma attenuatum (Kützing) Rabenhorst	Stoermer & Kreis 1978
Gyrosigma attenuatum var. hippocampus (W. Smith) Brock	Gaufin et al. 1976
Gyrosigma balticum (Ehrenberg) Rabenhorst	Kalinsky 1983
Gyrosigma delicatulum (W. Smith) Elmore	Elmore 1922
Gyrosigma distortum (W. Smith) Cleve	Hohn 1951
Gyrosigma distortum var. stauroneioides (Grunow) Cleve	Patrick & Reimer 1966
Gyrosigma exilis (Grunow) Reimer	Stoermer & Kreis 1978
Gyrosigma eximium (Thwaites) Boyer	Collins & Kalinsky 1977
Gyrosigma fasciola (Ehrenberg) Griffen & Henfrey	Rushforth & Merkley 1988
Gyrosigma kuetzingii (Grunow) Cleve	Stoermer & Kreis 1978
Gyrosigma macrum (W. Smith) Griffen & Henfrey	Collins & Kalinsky 1977
Gyrosigma nodiferum (Grunow) Reimer	Stoermer & Kreis 1978
Gyrosigma obliquum (Grunow) Boyer	Kalinsky 1983
Gyrosigma obscurum (W. Smith) Griffen & Henfrey	Camburn 1982

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<i>Gyrosigma obtusatum</i> (Sullivan & Wormley) Boyer	Camburn 1982
<i>Gyrosigma parkeri</i> (Harrison) Boyer	Stoermer & Kreis 1978
<i>Gyrosigma parvulum</i> (Kützing) Rabenhorst	Collins & Kalinsky 1977
<i>Gyrosigma peisonis</i> (Grunow) Hustedt	Collins & Kalinsky 1977
<i>Gyrosigma reimeri</i> Sterrenburg	Stoermer et al. 1999
<i>Gyrosigma scalproides</i> (Rabenhorst) Cleve	Stoermer & Kreis 1978
<i>Gyrosigma scalproides</i> var. <i>obliqua</i> (Grunow) Cleve	Patrick & Reimer 1966
<i>Gyrosigma sciotense</i> (Sullivan & Wormley) Cleve	Stoermer & Kreis 1978
<i>Gyrosigma spencerii</i> (Quekett) Griffen & Henfrey	Stoermer & Kreis 1978
<i>Gyrosigma spencerii</i> var. <i>curvula</i> (Grunow) Reimer	Stoermer & Kreis 1978
<i>Gyrosigma spencerii</i> var. <i>nodifera</i> Grunow	Stoermer & Kreis 1978
<i>Gyrosigma strigile</i> (W. Smith) Cleve	Stoermer & Kreis 1978
<i>Gyrosigma temperei</i> Cleve	Stoermer & Kreis 1978
<i>Gyrosigma terryanum</i> f. <i>fontanum</i> Reimer	Patrick & Reimer 1966
<i>Gyrosigma wormleyi</i> (Sullivant) Boyer	Stoermer & Kreis 1978
<i>Hannaea arcus</i> (Ehrenberg) Patrick	Stoermer & Kreis 1978
<i>Hannaea arcus</i> var. <i>amphioxys</i> (Rabenhorst) Patrick	Stoermer & Kreis 1978
<i>Hannaea arcus</i> var. <i>linearis</i> Holmboe	Stoermer & Kreis 1978
<i>Hantzschia amphioxys</i> (Ehrenberg) Grunow	Stoermer & Kreis 1978
<i>Hantzschia amphioxys</i> f. <i>capitata</i> O. Müller	Camburn 1982
<i>Hantzschia amphioxys</i> var. <i>capitata</i> O. Müller	Stoermer & Kreis 1978
<i>Hantzschia amphioxys</i> var. <i>elongata</i> Grunow	Tempère & Peragallo 1908
<i>Hantzschia amphioxys</i> var. <i>intermedia</i> Grunow	Clark & Rushforth 1977
<i>Hantzschia amphioxys</i> var. <i>leptocephala</i> Østrup	Clark & Rushforth 1977
<i>Hantzschia amphioxys</i> var. <i>linearis</i> (O. Müller) Cleve-Euler	Rushforth & Merkle 1988
<i>Hantzschia amphioxys</i> var. <i>major</i> Grunow	Hohn 1951
<i>Hantzschia amphioxys</i> var. <i>vivax</i> (Hantzsch) Grunow	Stoermer & Kreis 1978
<i>Hantzschia distincta-punctata</i> Hustedt	Hohn 1961
<i>Hantzschia elongata</i> Grunow	Boyer 1927b
<i>Hantzschia pseudomarina</i> Hustedt	Hohn 1951
<i>Hantzschia virgata</i> (Roper) Grunow in Grunow & Cleve	Stoermer et al. 1999
<i>Hantzschia virgata</i> var. <i>capitellata</i> Hustedt	Stoermer et al. 1999
<i>Hantzschia vivax</i> var. <i>granulata</i> M. Peragallo in Tempère & Peragallo	Tempère & Peragallo 1908
<i>Himantidium arcus</i> Ehrenberg	Kalinsky 1983
<i>Himantidium bidens</i> Ehrenberg	Kalinsky 1983
<i>Himantidium carinatum</i>	Ehrenberg 1856
<i>Himantidium gracile</i>	Ehrenberg 1856
<i>Himantidium monodon</i>	Ehrenberg 1856
<i>Himantidium parallelum</i> Ehrenberg	Kalinsky 1983
<i>Himantidium pectinale</i> Kützing	Kalinsky 1983
<i>Himantidium pectinale</i> var. <i>major</i>	H.L. Smith 1876–1888 (#193)
<i>Himantidium ternarium</i>	Ehrenberg 1856
<i>Himantidium undulatum</i> W. Smith	Kalinsky 1983
<i>Hippodonta capitata</i> (Ehrenberg) Lange-Bertalot, Metzeltin & Witkowski	Stoermer et al. 1999
<i>Hippodonta costulata</i> (Grunow) Lange-Bertalot, Metzeltin & Witkowski	Stoermer et al. 1999
<i>Hippodonta hungarica</i> (Grunow) Lange-Bertalot, Metzeltin & Witkowski	Stoermer et al. 1999
<i>Hippodonta kaiserii</i> Lange-Bertalot, Metzeltin & Witkowski	Lange-Bertalot et al. 1996
<i>Hippodonta linearis</i> (Østrup) Lange-Bertalot, Metzeltin & Witkowski	Stoermer et al. 1999
<i>Hippodonta lueneburgensis</i> (Grunow) Lange-Bertalot, Metzeltin & Witkowski	Stoermer et al. 1999
<i>Hippodonta subcostulata</i> (Hustedt) Lange-Bertalot, Metzeltin & Witkowski	Stoermer et al. 1999
<i>Homoeocladia acicularis</i> (Kützing) Kuntze	Elmore 1922
<i>Homoeocladia amphibia</i> (Grunow) Kuntze	Elmore 1922

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<i>Homoeocladia amphioxys</i> (Ehrenberg) Kuntze	Collins & Kalinsky 1977
<i>Homoeocladia angustata</i> (W. Smith) Kuntze	Elmore 1922
<i>Homoeocladia apiculata</i> (Gregory) Kuntze	Elmore 1922
<i>Homoeocladia arcus</i> (Buhlhein) Kuntze	Elmore 1922
<i>Homoeocladia brebissonii</i> (W. Smith) Kuntze	Elmore 1922
<i>Homoeocladia commutata</i> (Grunow) Kuntze	Elmore 1922
<i>Homoeocladia dissipata</i> (Kützing) Kuntze	Elmore 1922
<i>Homoeocladia dubia</i> (W. Smith) Elmore	Elmore 1922
<i>Homoeocladia fasciculata</i> (Grunow) Kuntze	Elmore 1922
<i>Homoeocladia filiformis</i> W. Smith	Boyer 1927b
<i>Homoeocladia frustulum</i> (Kützing) Kuntze	Elmore 1922
<i>Homoeocladia hungarica</i> (Grunow) Kuntze	Elmore 1922
<i>Homoeocladia intermedia</i> (Hantzsch) Kuntze	Elmore 1922
<i>Homoeocladia lanceolata</i> (W. Smith) Kuntze	Elmore 1922
<i>Homoeocladia linearis</i> (Agardh) Kuntze	Elmore 1922
<i>Homoeocladia obtusa</i> (Lyngbye) Elmore	Elmore 1922
<i>Homoeocladia palea</i> (Kützing) Kuntze	Collins & Kalinsky 1977
<i>Homoeocladia paxillifer</i> (Müller) Elmore	Elmore 1922
<i>Homoeocladia punctata</i> (W. Smith) Kuntze	Elmore 1922
<i>Homoeocladia sigma</i> (Kützing) Kuntze	Elmore 1922
<i>Homoeocladia sigmoidea</i> (Nitzsch) Elmore	Stoermer & Kreis 1978
<i>Homoeocladia spectabilis</i> (Ehrenberg) Kuntze	Elmore 1922
<i>Homoeocladia subtilis</i> (Grunow) Kuntze	Elmore 1922
<i>Homoeocladia tabellaria</i> (Grunow) Kuntze	Elmore 1922
<i>Homoeocladia tryblionella</i> (Hantzsch) Kuntze	Elmore 1922
<i>Homoeocladia umbonata</i> (Ehrenberg) Kuntze	Elmore 1922
<i>Homoeocladia vermicularis</i> (Kützing) Kuntze	Collins & Kalinsky 1977
<i>Homoeocladia virgata</i> (Roper) Kuntze	Elmore 1922
<i>Homoeocladia vitrea</i> (Norman) Kuntze	Elmore 1922
<i>Hyalodiscus californicus</i>	Collins & Kalinsky 1977
<i>Hyalodiscus whitneyi</i> Ehrenberg	Kaczmarek & Rushforth 1983
<i>Hyalosynedra laevigata</i> (Grunow) Williams & Round	Stoermer et al. 1999
<i>Hydrosera triquetra</i> Wallich	Whitford & Schumacher 1973
<i>Karayevia clevei</i> (Grunow in Cleve & Grunow) Round & Bukhtiyarova	Stoermer et al. 1999
<i>Karayevia laterostrata</i> (Hustedt) Round & Bukhtiyarova	Stoermer et al. 1999
<i>Kobayasia jaagii</i> (Meister) Lange-Bertalot	Stoermer et al. 1999
<i>Kobayasia subtilissima</i> (Cleve) Lange-Bertalot	Stoermer et al. 1999
<i>Kobayasiella madumensis</i> (Jørgensen) Lange-Bertalot	Siver et al. 2005
<i>Kobayasiella pseudosubtilissima</i> (Manguin) Lange-Bertalot	Siver et al. 2005
<i>Kolbesia kolbei</i> (Hustedt) Round & Bukhtiyarova	Stoermer et al. 1999
<i>Kolbesia ploenensis</i> (Hustedt) Round & Bukhtiyarova	Stoermer et al. 1999
<i>Krasskella kriegera</i> (Krasske) Ross & Sims	Camburn 1982
<i>Lemnicola hungarica</i> (Grunow) Round & Basson	Johansen et al. 2004
<i>Licmophora flabellata</i>	Whitford 1956
<i>Licmophora gracilis</i> (Ehrenberg) Grunow	Rushforth & Merkley 1988
<i>Licmophora tineta</i> (Agardh) Grunow	Whitford & Schumacher 1973

Name	Publication
<i>Luticola cohnii</i> (Hilse) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Luticola goeppertiana</i> (Bleisch) D.G. Mann in Round et al.	Johansen et al. 2004
<i>Luticola mutica</i> (Kützing) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Luticola muticoides</i> (Hustedt) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Luticola muticopsis</i> (Van Heurck) D.G. Mann in Round et al.	Stoermer et al. 1999
<i>Luticola naviculoides</i> Johansen in Johansen et al.	Johansen et al. 2004
<i>Luticola nivalis</i> (Ehrenberg) Andresen et al.	Andresen et al. 2000
<i>Luticola saxophila</i> (Bock ex Hustedt) D.G. Mann	Gaiser & Johansen 2000
<i>Luticola stigma</i> (Patrick) Johansen in Johansen et al.	Johansen et al. 2004
<i>Luticola terminata</i> (Hustedt) Johansen in Johansen et al.	Johansen et al. 2004
<i>Luticola terminata</i> var. <i>rostrata</i> (Krasske) Johansen in Johansen et al.	Johansen et al. 2004
<i>Luticola undulata</i> (Hilse) Andresen et al.	Andresen et al. 2000
<i>Lysigonium crenulatum</i> (Kützing) Kuntze	Elmore 1922
<i>Lysigonium distans</i> (Kützing) Kuntze	Elmore 1922
<i>Lysigonium granulata</i> (Ehrenberg) Kuntze	Stoermer & Kreis 1978
<i>Lysigonium varians</i> (Agardh) De Toni	Stoermer & Kreis 1978
<i>Martynana martyi</i> (Héribaud) Round in Round et al.	Stoermer et al. 1999
<i>Mastogloia angusta</i> Hustedt	Hustedt 1933
<i>Mastogloia aquilegiae</i> Grunow	Kaczmarek & Rushforth 1983
<i>Mastogloia braunii</i> Grunow	Stoermer & Kreis 1978
<i>Mastogloia crucicula</i> (Grunow) Cleve	Kalinsky 1984
<i>Mastogloia dansei</i> Thwaites	Hohn 1951
<i>Mastogloia doddii</i> Stoermer ex Hungerford	Reimer 1990
<i>Mastogloia dubia</i> Kützing	Kalinsky 1983
<i>Mastogloia elliptica</i> (Agardh) Schonfeldt	Elmore 1922
<i>Mastogloia elliptica</i> var. <i>dansiei</i> (Thwaites) Cleve	Patrick & Reimer 1966
<i>Mastogloia exigua</i> Kützing	Tempère & Peragallo 1912
<i>Mastogloia grevillei</i> W. Smith	Stoermer & Kreis 1978
<i>Mastogloia jurgensii</i> Ag.	Kalinsky 1983
<i>Mastogloia lacustris</i> (Grunow) Van Heurck	Stoermer & Kreis 1978
<i>Mastogloia lanceolata</i> Kützing	Tilden 1894–1909 (#248)
<i>Mastogloia pumila</i> (Grunow) Cleve	Kalinsky 1983
<i>Mastogloia smithii</i> Thwaites	Stoermer & Kreis 1978
<i>Mastogloia smithii</i> var. <i>amphicephala</i> Grunow	Stoermer & Kreis 1978
<i>Mastogloia smithii</i> var. <i>lacustris</i> Grunow	Stoermer & Kreis 1978
<i>Melosira agassizzi</i> Ostensfeld	Stoermer & Kreis 1978
<i>Melosira agassizzi</i> var. <i>malayensis</i> Hustedt	Stoermer & Kreis 1978
<i>Melosira ambigua</i> (Grunow) O. Müller	Stoermer & Kreis 1978
<i>Melosira arenaria</i> Moore	Stoermer & Kreis 1978
<i>Melosira arenti</i> (Kolbe) Nagumo & Kobayasi	Hamilton et al. 1992
<i>Melosira binderana</i> Kützing	Stoermer & Kreis 1978
<i>Melosira borrieri</i> Greville	Whitford 1956
<i>Melosira canadensis</i> Hustedt	Stoermer & Kreis 1978
<i>Melosira crenulata</i> (Ehrenberg) Kützing	Stoermer & Kreis 1978
<i>Melosira crenulata</i> var. <i>tenuis</i> Kützing	Stoermer & Kreis 1978
<i>Melosira crotonensis</i> (J.W. Bailey) H.L. Smith	Stoermer & Kreis 1978
<i>Melosira dendroteres</i> (Rabenhorst) R. Ross	Stoermer et al. 1999
<i>Melosira dickiei</i> (Thwaites) Kützing	Stoermer et al. 1999
<i>Melosira distans</i> (Ehrenberg) Kützing	Stoermer & Kreis 1978
<i>Melosira distans</i> var. <i>africana</i> Müller	Hamilton et al. 1992
<i>Melosira distans</i> var. <i>alpigena</i> Grunow	Stoermer & Kreis 1978
<i>Melosira distans</i> var. <i>humilis</i> Cleve-Euler	Camburn & Kingston 1986
<i>Melosira distans</i> var. <i>limnetica</i> O. Müller	Stoermer et al. 1999

Name	Publication
<i>Melosira distans</i> var. <i>nivalis</i> (W. Smith) Kirchner	Camburn & Kingston 1986
<i>Melosira distans</i> var. <i>nivaloides</i> Camburn	Camburn & Kingston 1986
<i>Melosira distans</i> var. <i>pfaffiana</i> (Reinsch) Grunow	Rushforth & Merkle 1988
<i>Melosira distans</i> var. <i>tenella</i> (Nygaard) Florin	Camburn & Kingston 1986
<i>Melosira dubia</i> Kützing	Rushforth et al. 1986
<i>Melosira epidendron</i> (Ehrenberg) Boyer	Boyer 1927a
<i>Melosira granulata</i> (Ehrenberg) Ralfs	Stoermer & Kreis 1978
<i>Melosira granulata</i> var. <i>angustissima</i> O. Müller	Stoermer & Kreis 1978
<i>Melosira granulata</i> var. <i>angustissima</i> f. <i>curvata</i> Grunow	Stoermer & Kreis 1978
<i>Melosira granulata</i> var. <i>angustissima</i> f. <i>spiralis</i> Müller	Whitford & Schumacher 1973
<i>Melosira granulata</i> f. <i>curvata</i> Grunow	Stoermer et al. 1999
<i>Melosira granulata</i> var. <i>muzzanensis</i> (Meister) Bethge	Stoermer & Kreis 1978
<i>Melosira granulata</i> var. <i>procera</i> (Ehrenberg) Grunow	Camburn 1982
<i>Melosira granulata</i> f. <i>spiralis</i> Grunow	Stoermer & Kreis 1978
<i>Melosira herzogii</i> Lemmermann	Camburn & Kingston 1986
<i>Melosira islandica</i> O. Müller	Stoermer & Kreis 1978
<i>Melosira islandica</i> subsp. <i>helvetica</i> O. Müller	Stoermer & Kreis 1978
<i>Melosira italica</i> (Ehrenberg) Kützing	Stoermer & Kreis 1978
<i>Melosira italica</i> var. <i>multistriata</i> Patrick	Hohn 1961
<i>Melosira italica</i> var. <i>granulata</i> Grunow	Whitford & Schumacher 1973
<i>Melosira italica</i> var. <i>subarctica</i> O. Müller	Gaufin et al. 1976
<i>Melosira italica</i> var. <i>tenuis</i> (Grunow) O. Müller	Stoermer et al. 1999
<i>Melosira italica</i> var. <i>tenuissima</i> (Grunow) O. Müller	Stoermer & Kreis 1978
<i>Melosira italica</i> var. <i>valida</i> Grunow	Stoermer & Kreis 1978
<i>Melosira italica</i> subsp. <i>subarctica</i> O. Müller	Stoermer & Kreis 1978
<i>Melosira italica</i> subsp. <i>subarctica</i> f. <i>tenuissima</i> (Grunow) Camburn	Camburn & Kingston 1986
<i>Melosira juergensii</i> C.A. Agardh	Dodd 1987
<i>Melosira lacustris</i> H.H. Chase	Stoermer & Kreis 1978
<i>Melosira laevis</i> (Ehrenberg) Grunow	Hohn 1951
<i>Melosira lirata</i> (Ehrenberg) Kützing	Camburn & Kingston 1986
<i>Melosira lirata</i> f. <i>biseriata</i> (Grunow) Camburn	Camburn & Kingston 1986
<i>Melosira lirata</i> var. <i>lacustris</i> Grunow	Camburn & Kingston 1986
<i>Melosira longispina</i> Hustedt	Stoermer & Kreis 1978
<i>Melosira moniliformis</i> (O.F. Müller) Agardh	J.W. Bailey 1851
<i>Melosira nummuloides</i> (Dillwyn) Agardh	Kalinsky 1983
<i>Melosira nygaardii</i> Camburn	Camburn & Kingston 1986
<i>Melosira pensacolae</i> A. Schmidt	Sovereign 1958
<i>Melosira perglabra</i> Østrup	Camburn & Kingston 1986
<i>Melosira perglabra</i> var. <i>florinae</i> Camburn	Camburn & Kingston 1986
<i>Melosira pseudoamericana</i> Camburn	Camburn & Kingston 1986
<i>Melosira punctata</i> W. Smith	Cleve & Möller 1879
<i>Melosira roseana</i> Rabenhorst	Stoermer & Kreis 1978
<i>Melosira roeseana</i> var. <i>epidendron</i> (Ehrenberg) Grunow	Patrick 1945
<i>Melosira scalaris</i> Grunow	Tempère & Peragallo 1912
<i>Melosira semilaevis</i> Grunow	Tempère & Peragallo 1913
<i>Melosira solida</i> Eulenstein	Tempère & Peragallo 1912
<i>Melosira tenuis</i> Kützing	Tempère & Peragallo 1911
<i>Melosira tenuis</i> var. <i>ambigua</i> Grunow	Cleve & Möller 1879
<i>Melosira tenuissima</i> Grunow	Tempère & Peragallo 1911
<i>Melosira undulata</i> (Ehrenberg) Kützing	Stoermer & Kreis 1978
<i>Melosira undulata</i> var. <i>debilis</i>	Tempère & Peragallo 1913
<i>Melosira undulata</i> var. <i>normanii</i> Arnott	Stoermer & Kreis 1978
<i>Melosira varians</i> Agardh	Stoermer & Kreis 1978
<i>Melosira varennarum</i> M. Peragallo	Tempère & Peragallo 1909
<i>Meridion alansmithii</i> Brant	Brant 2003
<i>Meridion anceps</i> (Ehrenberg) Williams	Stoermer et al. 1999

Name	Publication
Meridion circulare (Greville) Agardh	Stoermer & Kreis 1978
Meridion circulare var. constrictum (Ralfs) Van Heurck	Stoermer & Kreis 1978
Meridion constrictum Ralfs	Stoermer & Kreis 1978
Meridion constrictum var. elongata Tempère & Peragallo	Tempère & Peragallo 1908
Meridion constrictum var. zinkenii Grunow	Tempère & Peragallo 1908
Meridion hohii Rhode	Rhode et al. 2001
Meridion lineare (H.L. Smith) D.M. Williams	Williams 1985
Meridion intermedium H.L. Smith	Stoermer & Kreis 1978
Meridion intermedium var. constrictum H.L. Smith	Stoermer & Kreis 1978
Meridion vernale Agardh	Stoermer & Kreis 1978
Meridion zenkenii Kützing	Tempère & Peragallo 1912
Microcostatus krasskei (Hustedt) Johansen & Sray	Johansen & Sray 1997
Microsiphona potamos Weber	Stoermer & Kreis 1978
Muelleria gibbula (Cleve) Spaulding & Stoermer	Spaulding et al. 1999
Muelleria terrestris (Petersen) Spaulding & Stoermer	Spaulding et al. 1999
Navicula abaujensis (Paut.) Beitr.	Myers 1989b
Navicula abiskoensis Hustedt	Collins & Kalinsky 1977
Navicula aboensis (Cleve) Hustedt	Stoermer & Kreis 1978
Navicula absoluta Hustedt	Stoermer & Kreis 1978
Navicula abunda Hustedt	Kalinsky 1983
Navicula acceptata Hustedt	Stoermer & Kreis 1978
Navicula accomoda Hustedt	Stoermer & Kreis 1978
Navicula achthera Hohn & Helleman	Hohn & Helleman 1963
Navicula acrosphaeria (Brébisson) Kützing	Elmore 1922
Navicula acrosphaeria var. brevis	Tempère & Peragallo 1909
Navicula acrosphaeria var. dilata Tempère & Peragallo	Tempère & Peragallo 1908
Navicula acrosphaeria var. laevis A. Schmidt	Tempère & Peragallo 1908
Navicula acrosphaeria var. minor M. Peragallo & Héribaud	Tempère & Peragallo 1908
Navicula admenda Hohn & Helleman	Patrick & Reimer 1966
Navicula adnata Hustedt	Patrick & Reimer 1966
Navicula adumbrata Hohn & Helleman	Patrick & Reimer 1966
Navicula adversa Krasske	Hohn & Helleman 1963
Navicula aequalis (Ehrenberg) Kützing	Patrick & Reimer 1966
Navicula aestuarii Cleve	Tempère & Peragallo 1911
Navicula affinis Ehrenberg	Stoermer & Kreis 1978
Navicula affine f. maxima Ehrenberg	Tempère & Peragallo 1908
Navicula agma Hohn & Helleman	Hohn & Helleman 1963
Navicula agnita Hustedt	Stoermer et al. 1999
Navicula agrestis Hustedt	Hohn & Helleman 1963
Navicula aikenenses Patrick	Stoermer & Kreis 1978
Navicula alea Hohn & Helleman	Hohn & Helleman 1963
Navicula algor Hohn & Helleman	Patrick & Reimer 1966
Navicula alpina W. Smith	Aubert 1895
Navicula alpina var. elongata M. Peragallo in Tempère & Peragallo	Tempère & Peragallo 1908
Navicula ambigua Ehrenberg	Stoermer & Kreis 1978
Navicula ambigua var. craticularis Ehrenberg	Stoermer & Kreis 1978
Navicula americana Ehrenberg	Stoermer & Kreis 1978
Navicula americana var. alastos Hohn & Helleman	Stoermer et al. 1999
Navicula americana var. bacillaris Peragallo & Héribaud	Stoermer 1964
Navicula americana var. minor Peragallo & Héribaud	Boyer 1927b
Navicula americana var. moesta Tempère & Peragallo	Patrick & Reimer 1966
Navicula ammophila var. flantica (Grunow) Cleve	Patrick & Reimer 1966
Navicula amnicola Hohn & Helleman	Hohn & Helleman 1963

Name	Publication
<i>Navicula amphibola</i> Cleve.	Boyer 1927b
<i>Navicula amphibola</i> var. <i>perrieri</i> Peragallo & Héribaud	Stoermer & Kreis 1978
<i>Navicula amphibola</i> var. <i>polymorpha</i> Fusey	Stoermer & Kreis 1978
<i>Navicula amphibola</i> var. <i>stauroneiformis</i>	Tempère & Peragallo 1909
<i>Navicula ampiceros</i> Kützing	Stoermer & Kreis 1978
<i>Navicula amphigomphus</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula amphilepta</i>	Ehrenberg 1856
<i>Navicula amphioxys</i> Ehrenberg	Patrick & Reimer 1966
<i>Navicula amphirhynchus</i> Ehrenberg	Kalinsky 1983
<i>Navicula amphisbaena</i> Bory	Elmore 1922
<i>Navicula amphisphenia</i> Ehrenberg	Kalinsky 1983
<i>Navicula ampliata</i> Ehrenberg	Tempère & Peragallo 1909
<i>Navicula amydalina</i> Hustedt	Stoermer et al. 1999
<i>Navicula anatis</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula anglica</i> Ralfs	Stoermer & Kreis 1978
<i>Navicula anglica</i> var. <i>lapponica</i> Cleve-Euler	Clark & Rushforth 1977
<i>Navicula anglica</i> var. <i>signata</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula anglica</i> var. <i>subsalsa</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Navicula angusta</i> Grunow	Camburn 1982
<i>Navicula anglica</i> var. <i>subsalsa</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Navicula angustata</i> W. Smith	Stoermer & Kreis 1978
<i>Navicula annexa</i> Hustedt	Dodd 1987
<i>Navicula antintescens</i> M. Peragallo in Tempère & Peragallo	Tempère & Peragallo 1908
<i>Navicula apiculata</i> Brébisson	Patrick & Reimer 1966
<i>Navicula appendiculata</i> Kützing	Stoermer & Kreis 1978
<i>Navicula arata</i> Grunow	Boyer 1927b
<i>Navicula arcissima</i> A. Schmidt	Tempère & Peragallo 1913
<i>Navicula arenaria</i> Donkin	Patrick & Reimer 1966
<i>Navicula arenula</i> Hohn & Hellerman	Patrick & Reimer 1966
<i>Navicula argutiola</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula arvensis</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula arverna</i> M. Peragallo & Héribaud	Patrick & Reimer 1966
<i>Navicula aspera</i> Ehrenberg	Tilden 1894–1909 (#367)
<i>Navicula asymbasia</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula aszellus</i> Weinhold ex Hustedt	Reimer 1970
<i>Navicula atomoides</i> Grunow in V.H.	Elmore 1922
<i>Navicula atomus</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Navicula atomus</i> var. <i>permitis</i> (Hustedt) Lange-Bertalot	Stoermer et al. 1999
<i>Navicula atomus</i> var. <i>recondita</i> (Hustedt) Lange-Bertalot	Stoermer et al. 1999
<i>Navicula auriculata</i> Hustedt	Camburn 1982
<i>Navicula aurora</i> Sovereign	Stoermer & Kreis 1978
<i>Navicula avenacea</i> Brébisson in Grunow	Hohn 1961
<i>Navicula bacillaris</i> Gregory	Stoermer & Kreis 1978
<i>Navicula bacillariformis</i> Grunow	Stoermer & Kreis 1978
<i>Navicula bacilloides</i> Hustedt	Fee 1967
<i>Navicula bacillum</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula bacillum</i> var. <i>lepida</i> (Gregory) Cleve	Rushforth & Merkley 1988
<i>Navicula bacula</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula balcanica</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula bastianii</i> M. Pergallo in Tempère & Peragallo	Boyer 1927b
<i>Navicula bdesma</i> Hohn	Patrick & Reimer 1966
<i>Navicula begeri</i> Krasske	Stoermer & Kreis 1978
<i>Navicula belliatula</i> Archibald	Dodd 1987
<i>Navicula bergenensis</i> Hohn	Patrick & Reimer 1966
<i>Navicula bicapitata</i> Lagerstedt	Stoermer & Kreis 1978
<i>Navicula bicapitata</i> var. <i>hybrida</i> Grunow	Tempère & Peragallo 1908
<i>Navicula bicapitellata</i> Hustedt	Stoermer & Kreis 1978

Name	Publication
<i>Navicula bicephala</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula biceps</i> Ehrenberg	Collins & Kalinsky 1977
<i>Navicula biconica</i> Patrick	Patrick 1959
<i>Navicula bicontracta</i> Østrup	Stoermer & Kreis 1978
<i>Navicula bievexa</i> Hohn	Patrick & Reimer 1966
<i>Navicula binodis</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula birhis</i> Hohn	Patrick & Reimer 1966
<i>Navicula bisulcata</i> Lagerstedt	Elmore 1922
<i>Navicula bita</i> Hohn	Patrick & Reimer 1966
<i>Navicula bogotensis</i> var. <i>ininterrupta</i> M. Peragallo in Tempère & Peragallo	Tempère & Peragallo 1908
<i>Navicula bogotensis</i> var. <i>undulata</i> M. Peragallo in Tempère & Peragallo	Tempère & Peragallo 1908
<i>Navicula bohémica</i> Ehrenberg	Rushforth & Merkley 1988
<i>Navicula borealis</i> (Ehrenberg) Kützing	Elmore 1922
<i>Navicula bottnica</i> Grunow	Bateman & Rushforth 1984
<i>Navicula braunii</i> Grunow	Elmore 1922
<i>Navicula braunii</i> var. <i>interrupta</i>	Tempère & Peragallo 1908
<i>Navicula brebissonii</i> Kützing	Stoermer & Kreis 1978
<i>Navicula brebissonii</i> var. <i>curta</i>	Tempère & Peragallo 1913
<i>Navicula brekkaensis</i> J.B. Petersen	Bateman & Rushforth 1984
<i>Navicula bremensis</i> Hustedt	Dixit & Smol 1995
<i>Navicula brevis</i> Gregory	Collins & Kalinsky 1977
<i>Navicula brevissima</i> Hustedt	Gaiser & Johansen 2000
<i>Navicula brockmannii</i> Hustedt	Dodd 1987
<i>Navicula bryophila</i> Østrup	Patrick & Reimer 1966
<i>Navicula bryophila</i> Peterson	Stoermer & Kreis 1978
<i>Navicula buccella</i> Hohn & Hellerman	Patrick & Reimer 1966
<i>Navicula caduca</i> Hustedt	Hohn & Hellerman 1963
<i>Navicula campylogramma</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula canalis</i> Patrick	Stoermer & Kreis 1978
<i>Navicula cancellata</i> var. <i>retusa</i> (Brébisson) Cleve	Patrick & Reimer 1966
<i>Navicula canoris</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula capitata</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula capitata</i> var. <i>hungarica</i> (Grunow) Ross	Stoermer & Kreis 1978
<i>Navicula capitata</i> var. <i>linearis</i> (Østrup) Stoermer & Kreis	Stoermer & Kreis 1978
<i>Navicula capitata</i> var. <i>luneburgensis</i> (Grunow) Patrick	Stoermer & Kreis 1978
<i>Navicula capitata</i> var. <i>lueneburgensis</i> f. <i>elegans</i> Østrup	Stoermer et al. 1999
<i>Navicula capitatoradiata</i> Germain	Yearsley et al. 1992
<i>Navicula capsula</i> Hohn	Stoermer & Kreis 1978
<i>Navicula caractacus</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula cardinalis</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula cari</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula cari</i> var. <i>angusta</i> Grunow	Stoermer & Kreis 1978
<i>Navicula carminata</i>	Patrick 1968
<i>Navicula carniolensis</i> Hustedt	Hohn & Hellerman 1963
<i>Navicula caroliniana</i> Patrick	Stoermer & Kreis 1978
<i>Navicula carolinensis</i> Ehrenberg	Patrick & Reimer 1966
<i>Navicula cascadenis</i> Sovereign	Stoermer & Kreis 1978
<i>Navicula caterva</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula cerneutia</i> Hohn	Patrick & Reimer 1966
<i>Navicula certa</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula charlatii</i> M. Peragallo	Dodd 1987
<i>Navicula charlatii</i> f. <i>simplex</i> Hustedt	Loescher 1981
<i>Navicula cincta</i> (Ehrenberg) Ralfs	Stoermer & Kreis 1978
<i>Navicula cincta</i> var. <i>angusta</i> (Grunow) Cleve	Patrick 1945
<i>Navicula cincta</i> var. <i>heufferli</i>	Tempère & Peragallo 1909
<i>Navicula cincta</i> var. <i>leptocephala</i> Brébisson ex Van Heurck	Collins & Kalinsky 1977
<i>Navicula cincta</i> var. <i>minuta</i> Grunow	Patrick & Reimer 1966

Name	Publication
<i>Navicula cincta</i> var. <i>rostrata</i> Reimer	Collins & Kalinsky 1977
<i>Navicula cinna</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula circumtexta</i> Meister	Stoermer & Kreis 1978
<i>Navicula citrus</i> Krasske	Stoermer & Kreis 1978
<i>Navicula clamans</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula clementis</i> Grunow	Stoermer & Kreis 1978
<i>Navicula clementis</i> var. <i>linearis</i> Brander	Stoermer & Kreis 1978
<i>Navicula clementis</i> var. <i>quadristigmata</i> Manguin	Stoermer & Kreis 1978
<i>Navicula clementoides</i> Hustedt	Stoermer et al. 1999
<i>Navicula cocconeiformis</i> Gregory	Stoermer & Kreis 1978
<i>Navicula cocconeis</i> (Ehrenberg) De Toni	Patrick & Reimer 1966
<i>Navicula columbiana</i> Hustedt	Hustedt 1966
<i>Navicula columnaris</i> Ehrenberg	Tempère & Peragallo 1908
<i>Navicula commutata</i> Grunow	Tempère & Peragallo 1909
<i>Navicula complanata</i> Hustedt	Hustedt 1962
<i>Navicula concava</i> Patrick	Patrick 1945
<i>Navicula confervacea</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Navicula confervacea</i> var. <i>peregrina</i> (W. Smith) Grunow	Stoermer & Kreis 1978
<i>Navicula constans</i> Hustedt	Clark & Rushforth 1977
<i>Navicula constans</i> var. <i>symmetrica</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula contempta</i> Hustedt	Collins & Kalinsky 1977
<i>Navicula contenta</i> Grunow	Stoermer & Kreis 1978
<i>Navicula contenta</i> f. <i>biceps</i>	Patrick 1968
<i>Navicula contenta</i> f. <i>parallela</i> (Petersen) Hustedt	Rushforth & Merkley 1988
<i>Navicula contenta</i> var. <i>biceps</i> (Arnott) Grunow	Stoermer & Kreis 1978
<i>Navicula contortula</i> Sovereign	Patrick & Reimer 1966
<i>Navicula contraria</i> Patrick	Stoermer & Kreis 1978
<i>Navicula convergens</i> Patrick	Patrick 1959
<i>Navicula costata</i> Ehrenberg	Tempère & Peragallo 1909
<i>Navicula costulata</i> Cleve & Grunow	Stoermer & Kreis 1978
<i>Navicula costuloides</i> Skvortzow	Stoermer et al. 1999
<i>Navicula cremorne</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula cristula</i> Hohn	Patrick & Reimer 1966
<i>Navicula crucialis</i> (O. Müller) Frenguelli	Kociolek & Herbst 1992
<i>Navicula crucicula</i> (W. Smith) Donkin	Stoermer & Kreis 1978
<i>Navicula creuzburgensis</i> var. <i>multistriata</i> Patrick	Patrick 1959
<i>Navicula cryptocefala</i> Lange-Bertalot	Stoermer et al. 1999
<i>Navicula cryptocephala</i> Kützing	Stoermer & Kreis 1978
<i>Navicula cryptocephala</i> var. <i>exilis</i> (Kützing) Grunow	Camburn 1982
<i>Navicula cryptocephala</i> var. <i>intermedia</i> Van Heurck	Stoermer & Kreis 1978
<i>Navicula cryptocephala</i> var. <i>lancetula</i> (Schumann) Grunow	Stoermer & Kreis 1978
<i>Navicula cryptocephala</i> f. <i>minuta</i> Boye Peterson	Hohn & Hellerman 1963
<i>Navicula cryptocephala</i> var. <i>pumila</i> Grunow	Patrick 1945
<i>Navicula cryptocephala</i> f. <i>terrestris</i> Lund	Collins & Kalinsky 1977
<i>Navicula cryptocephala</i> var. <i>veneta</i> (Kützing) Rabenhorst	Stoermer & Kreis 1978
<i>Navicula cryptocephaloides</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula cryptogaster</i> Lowe	Lowe 1972–1973
<i>Navicula cryptonella</i> Lange-Bertalot	Stoermer et al. 1999
<i>Navicula cryptonella</i> Lange-Bertalot	Potapova & Charles 2002
<i>Navicula cuspidata</i> (Kützing) Kützing	Stoermer & Kreis 1978
<i>Navicula cuspidata</i> var. <i>ambigua</i> (Ehrenberg) Cleve	Boyer 1927b
<i>Navicula cuspidata</i> var. <i>danaica</i> Grunow in Cleve	Patrick & Reimer 1966
<i>Navicula cuspidata</i> var. <i>héribaudi</i> Peragallo	Patrick & Reimer 1966
<i>Navicula cuspidata</i> var. <i>major</i> Meister	Boyer 1927b
<i>Navicula cuspidata</i> var. <i>obtusa</i> Patrick	Patrick & Reimer 1966
<i>Navicula cynthia</i> A. Schmidt	Collins & Kalinsky 1977
<i>Navicula cyrpinus</i> W. Smith	Tempère & Peragallo 1909

Name	Publication
<i>Navicula dactylus</i> Ehrenberg	Aubert Le Diatomiste #20
<i>Navicula dailyi</i> Reimer	Patrick & Reimer 1966
<i>Navicula dariana</i> A. Schmidt	Tempère & Peragallo 1908
<i>Navicula declivis</i> Hustedt	Stoermer et al. 1999
<i>Navicula decurrens</i> (Ehrenberg) Kützing	Elmore 1922
<i>Navicula decussis</i> Østrup	Stoermer & Kreis 1978
<i>Navicula demerara</i> Grunow ex Cleve	Patrick & Reimer 1966
<i>Navicula demissa</i> Hustedt	Drum 1981
<i>Navicula denestriata</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula detenta</i> Hustedt	Stoermer et al. 1999
<i>Navicula diagonalis</i>	Patrick & Reimer 1966
<i>Navicula dicephala</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula dicephala</i> var. <i>abiskonensis</i> (Hustedt) A. Cleve	Stoermer & Kreis 1978
<i>Navicula dicephala</i> var. <i>elginensis</i> (Gregory) Cleve	Stoermer & Kreis 1978
<i>Navicula dicephala</i> var. <i>lata</i> M. Peragallo in Tempère & Peragallo	Tempère & Peragallo 1908
<i>Navicula dicephala</i> var. <i>subcapitata</i> Grunow	Patrick & Reimer 1966
<i>Navicula dibola</i> Hohn	Patrick & Reimer 1966
<i>Navicula difficillima</i> Hustedt	Camburn & Charles 2000
<i>Navicula difficillimoides</i> Hustedt	Grimes & Rushforth 1982
<i>Navicula digito-radiata</i> (Gregory) Ralfs	Collins & Kalinsky 1977
<i>Navicula digitulus</i> Hustedt	Bateman & Rushforth 1984
<i>Navicula dilatata</i> Ehrenberg	Ehrenberg 1856
<i>Navicula diluviana</i> Krasske	Stoermer & Kreis 1978
<i>Navicula diserta</i> Hustedt	Kalinsky 1983
<i>Navicula disjuncta</i> Hustedt	Hamilton et al. 1992
<i>Navicula dismutica</i> Hustedt	Loescher 1981
<i>Navicula disputans</i> Patrick	Stoermer & Kreis 1978
<i>Navicula dissipata</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula distinctastriata</i> Hohn & Hellerman	Stoermer & Kreis 1978
<i>Navicula divergens</i> (W. Smith) Ralfs	Stoermer & Kreis 1978
<i>Navicula divergens</i> var. <i>bacillaris</i> M. Peragallo in Tempère & Peragallo	Tempère & Peragallo 1908
<i>Navicula dubia</i> W. Smith	Stoermer & Kreis 1978
<i>Navicula dubia</i> var. <i>acuminata</i> Tempère & Peragallo	Tempère & Peragallo 1911
<i>Navicula dulcis</i> Patrick	Stoermer & Kreis 1978
<i>Navicula duomedia</i> Patrick	Patrick 1959
<i>Navicula dystrophica</i> Patrick	Patrick 1959
<i>Navicula ebor</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula eiowana</i> Ehrenberg	Patrick & Reimer 1966
<i>Navicula elaphros</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula elata</i> Gandhi	Collins & Kalinsky 1977
<i>Navicula elegans</i> W. Smith	Stoermer & Kreis 1978
<i>Navicula elegans</i> var. <i>cuspidata</i> Cleve	Hohn 1951
<i>Navicula elegantissima</i> M. Peragallo in Tempère & Peragallo	Tempère & Peragallo 1908
<i>Navicula elginensis</i> (Gregory) Ralfs	Stoermer & Kreis 1978
<i>Navicula elginensis</i> f. <i>abiskoensis</i> Hustedt	Clark & Rushforth 1977
<i>Navicula elginensis</i> var. <i>lata</i> (M. Peragallo) Patrick	Stoermer & Kreis 1978
<i>Navicula elginensis</i> var. <i>neglecta</i> (Krasske) Patrick	Camburn 1982
<i>Navicula elginensis</i> var. <i>rostrata</i> (A. Mayer) Patrick	Stoermer & Kreis 1978
<i>Navicula elginensis</i> var. <i>subcapitata</i> Grunow	Clark & Rushforth 1977
<i>Navicula elliptica</i> Kützing	Stoermer & Kreis 1978
<i>Navicula elliptica</i> var. <i>minutissima</i> Grunow	Stoermer & Kreis 1978
<i>Navicula elliptica</i> var. <i>ostracodarum</i>	Tempère & Peragallo 1909
<i>Navicula elmorei</i> Patrick	Patrick & Reimer 1966
<i>Navicula elongata</i>	Ehrenberg 1856
<i>Navicula entomon</i> Ehrenberg	Collins & Kalinsky 1977
<i>Navicula eponka</i> Hohn	Patrick & Reimer 1966
<i>Navicula erifuga</i> Lange-Bertalot	Johansen et al. 2004

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<i>Navicula esox</i> Ehrenberg	Ehrenberg 1856
<i>Navicula evexa</i> Sovereign	Patrick & Reimer 1966
<i>Navicula excelsa</i> Krasske	Stoermer & Kreis 1978
<i>Navicula exigua</i> (Gregory) Grunow	Stoermer & Kreis 1978
<i>Navicula exigua</i> var. <i>capitata</i> Patrick	Stoermer & Kreis 1978
<i>Navicula exiguaformis</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula exibuoides</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula exilis</i> Kützing	Stoermer & Kreis 1978
<i>Navicula exilissima</i> Grunow	Collins & Kalinsky 1977
<i>Navicula explanata</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula exselsa</i> Krasske	Rushforth & Merkley 1988
<i>Navicula exsul</i> A. Schmidt	Patrick & Reimer 1966
<i>Navicula falaisensis</i> Grunow	Boyer 1927b
<i>Navicula farta</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula fasciata</i> Lagerstedt	Tempère & Peragallo 1908
<i>Navicula festiva</i> Krasske	Stoermer & Kreis 1978
<i>Navicula feuerborni</i> Hustedt	Kaczmarska & Rushforth 1983
<i>Navicula finnica</i> Cleve	Tempère & Peragallo 1909
<i>Navicula firma</i> Kützing & Grunow	Aubert 1895
<i>Navicula firma</i> var. <i>amphigomphus</i> Ehrenberg	Cleve & Möller 1879
<i>Navicula firma</i> var. <i>dilatata</i>	Cleve & Möller 1878
<i>Navicula firma</i> var. <i>iris</i>	Cleve & Möller 1879
<i>Navicula firma</i> var. <i>subampliata</i>	Tempère & Peragallo 1912
<i>Navicula firma</i> var. <i>tumescens</i> Grunow	Cleve & Möller 1878
<i>Navicula flanatica</i> Grunow	Kalinsky 1983
<i>Navicula flavasinus</i> Moghadam	Prescott & Dillard 1979
<i>Navicula flexuosa</i>	Ehrenberg 1856
<i>Navicula flexuosa</i> var. <i>cuneata</i> Tempère & Peragallo	Tempère & Peragallo 1909
<i>Navicula fluens</i> Hustedt	Dodd 1987
<i>Navicula fluminitica</i> Camburn	Camburn 1982
<i>Navicula forcipata</i> Greville	Patrick & Reimer 1966
<i>Navicula formica</i> Ehrenberg	Cleve & Möller 1878
<i>Navicula fossalis</i> Krasske	Collins & Kalinsky 1977
<i>Navicula fracta</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula fragilarioides</i> Krasske	Bateman & Rushforth
<i>Navicula friesneri</i> Reimer	Patrick & Reimer 1966
<i>Navicula fritschii</i> Lund	Patrick & Reimer 1966
<i>Navicula frugalis</i> Hustedt	Hohn & Hellerman 1963
<i>Navicula fulva</i> (Nitzsch) Ehrenberg	Elmore 1922
<i>Navicula fusidium</i> Ehrenberg	Kalinsky 1983
<i>Navicula gallica</i> (W. Smith) Van Heurck	Johansen et al 1983
<i>Navicula gallica</i> var. <i>nitzschioides</i> Grunow	Patrick & Reimer 1966
<i>Navicula gallica</i> var. <i>perpusilla</i> (Grunow) Lange-Bertalot	Camburn & Charles 2000
<i>Navicula gastriformis</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula gastrum</i> (Ehrenberg) Kützing	Stoermer & Kreis 1978
<i>Navicula gastrum</i> f. <i>maxima</i> Tempère & Peragallo	Tempère & Peragallo 1909
<i>Navicula gastrum</i> var. <i>exigua</i> (Gregory) Grunow	Patrick & Reimer 1966
<i>Navicula gastrum</i> var. <i>signata</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula gaufinii</i> Moghadam	Prescott & Dillard 1979
<i>Navicula genovefea</i> Fusey	Hohn & Hellerman 1963
<i>Navicula gentilis</i> Donkin	Tempère & Peragallo 1908
<i>Navicula germanii</i> Wallich	Hohn 1961
<i>Navicula germanii</i> Wallace	Patrick 1968
<i>Navicula gibba</i> (Ehrenberg) Kützing	Stoermer & Kreis 1978
<i>Navicula gibba</i> var. <i>hyalina</i>	Tempère & Peragallo 1909
<i>Navicula gibbosa</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula gibbula</i> Cleve	Patrick & Reimer 1966

Name	Publication
<i>Navicula gigas</i> Ehrenberg	Tempère & Peragallo 1908
<i>Navicula globiceps</i> Gregory	Stoermer & Kreis 1978
<i>Navicula globosa</i> Meister	Stoermer & Kreis 1978
<i>Navicula globulifera</i> Hustedt	Patrick 1945
<i>Navicula goeppertiana</i> (Bleisch) H.L. Smith	Stoermer et al. 1999
<i>Navicula goersii</i> Bahls	Bahls 1983
<i>Navicula gottlandica</i> Grunow	Stoermer & Kreis 1978
<i>Navicula gracilis</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula gracilis</i> f. <i>minor</i>	Patrick 1968
<i>Navicula gracilis</i> var. <i>schizonemoides</i> Van Heurck	Stoermer & Kreis 1978
<i>Navicula gracillima</i> Ralfs	Tempère & Peragallo 1911
<i>Navicula graciloides</i> A. Mayer	Stoermer & Kreis 1978
<i>Navicula gravistriata</i> Patrick	Patrick 1959
<i>Navicula gregaria</i> Donkin	Stoermer & Kreis 1978
<i>Navicula grimmei</i> Krasske	Stoermer & Kreis 1978
<i>Navicula guatemalensis</i> Cleve & Grove	Patrick & Reimer 1966
<i>Navicula guttata</i> Grunow	Patrick & Reimer 1966
<i>Navicula gysingensis</i> Foged	Stoermer & Kreis 1978
<i>Navicula habena</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula halophila</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Navicula halophila</i> var. <i>minor</i> Kolbe	Patrick 1945
<i>Navicula halophila</i> var. <i>subcapitata</i> Østrup	Collins & Kalinsky 1977
<i>Navicula halophila</i> f. <i>tenuirostris</i> Hustedt	Camburn 1982
<i>Navicula hambergii</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula harderi</i> Hustedt	Prescott & Dillard 1979
<i>Navicula hasta</i> var. <i>punctata</i> Boyer	Patrick & Reimer 1966
<i>Navicula hassiaca</i> Krasske	Stoermer & Kreis 1978
<i>Navicula hasta</i> Pantocsek	Stoermer & Kreis 1978
<i>Navicula hyalosirella</i> Hustedt	Hustedt 1962
<i>Navicula hebes</i> Ralfs	Cleve & Möller 1878
<i>Navicula helensis</i> Schulz	Stoermer & Kreis 1978
<i>Navicula hemiptera</i> Kützing	Stoermer & Kreis 1978
<i>Navicula hemiptera</i> var. <i>troiana</i> Grunow	Cleve & Möller 1879
<i>Navicula heroina</i> A. Schmidt	Patrick & Reimer 1966
<i>Navicula heufleri</i> Grunow	Stoermer & Kreis 1978
<i>Navicula heufleri</i> var. <i>leptocephala</i> (Brébisson) Patrick	Stoermer & Kreis 1978
<i>Navicula hexapla</i> A. Schmidt	Patrick & Reimer 1966
<i>Navicula hilseana</i> Janisch	Tempère & Peragallo 1912
<i>Navicula hitchcockii</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula hudsonis</i> Grunow	Kalinsky 1983
<i>Navicula humerosa</i> Brébisson	Patrick & Reimer 1966
<i>Navicula humilis</i> Donkin	Boyer 1927b
<i>Navicula hungarica</i> Grunow	Stoermer & Kreis 1978
<i>Navicula hungarica</i> var. <i>capitata</i> (Ehrenberg) Cleve	Stoermer & Kreis 1978
<i>Navicula hungarica</i> var. <i>linearis</i> Østrup	Stoermer & Kreis 1978
<i>Navicula hustedtii</i> Krasske	Camburn 1982
<i>Navicula hustedtii</i> f. <i>obtusa</i> (Hustedt) Hustedt	Stoermer & Kreis 1978
<i>Navicula hustedtii</i> f. <i>philippina</i> Skvortzow	Hohn & Hellerman 1963
<i>Navicula hyalinula</i> De Toni	Kalinsky 1983
<i>Navicula icostauron</i> (Ehrenberg) O'Meara	Van Heurck & Grunow 1881–1885 (#138)
<i>Navicula illinoensis</i>	Ehrenberg 1856
<i>Navicula imbellis</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula imbricata</i> Bock	Stoermer & Kreis 1978
<i>Navicula ingrata</i> Krasske	Prescott & Dillard 1979
<i>Navicula importuna</i> Hustedt	Stoermer et al. 1999
<i>Navicula incerta</i> Grunow	Stoermer & Kreis 1978
<i>Navicula incommitatus</i> Hohn & Hellerman	Patrick & Reimer 1966

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<i>Navicula incomposita</i> Hagelstein	Kalinsky 1983
<i>Navicula incompta</i> var. <i>incurva</i> Reimer	Reimer 1990
<i>Navicula indemnis</i> Hohn & Helleman	Patrick & Reimer 1966
<i>Navicula indianensis</i> Reimer	Patrick & Reimer 1966
<i>Navicula indifferens</i> Hustedt	Hohn & Helleman 1963
<i>Navicula inflata</i> Donkin	Stoermer & Kreis 1978
<i>Navicula inflexa</i> (Gregory) Ralfs	Stoermer & Kreis 1978
<i>Navicula infrenis</i> Hohn & Helleman	Hohn & Helleman 1963
<i>Navicula ingenua</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula ingrata</i> Krasske	Stoermer & Kreis 1978
<i>Navicula insignita</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula insociabilis</i> Krasske	Stoermer & Kreis 1978
<i>Navicula insociabilis</i> var. <i>dissipatoides</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula instabilis</i> A. Schmidt	Tempère & Peragallo 1909
<i>Navicula integra</i> (W. Smith) Ralfs	Stoermer & Kreis 1978
<i>Navicula interglacialis</i> Hustedt	Stoermer et al. 1999
<i>Navicula intermedia</i> Lagerstedt	Elmore 1922
<i>Navicula interrupta</i> W. Smith	Tempère & Peragallo 1909
<i>Navicula interrupta</i> var. <i>stauroneiformis</i>	Tempère & Peragallo 1909
<i>Navicula intracata</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula iridis</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula iridis</i> var. <i>affinis</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula iridis</i> var. <i>amphigomphus</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula iridis</i> var. <i>amphirhynchus</i> (Ehrenberg) Cleve	Stoermer & Kreis 1978
<i>Navicula iridis</i> var. <i>ampliata</i> Ehrenberg	Tempère & Peragallo 1908
<i>Navicula iridis</i> var. <i>firma</i> W. Smith	Stoermer & Kreis 1978
<i>Navicula iridis</i> var. <i>maxima</i>	Tempère & Peragallo 1909
<i>Navicula iridis</i> var. <i>producta</i> W. Smith	Stoermer & Kreis 1978
<i>Navicula illinoensis</i>	Ehrenberg 1856
<i>Navicula isocephala</i> Ehrenberg	Cleve & Möller 1878
<i>Navicula jaagi</i> Meister	Stoermer & Kreis 1978
<i>Navicula jaerenfeltii</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula jentzschii</i> Grunow	Stoermer & Kreis 1978
<i>Navicula johnsonii</i> O'Meara	Aubert 1895
<i>Navicula karsia</i> Hohn	Patrick & Reimer 1966
<i>Navicula keeleyi</i> Patrick	Camburn 1982
<i>Navicula kincaidii</i> Sovereign	Patrick & Reimer 1966
<i>Navicula kisber</i> Hohn & Helleman	Patrick & Reimer 1966
<i>Navicula kotschyi</i> Grunow	Stoermer & Kreis 1978
<i>Navicula krasskei</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula lacunarum</i> Grunow	Stoermer & Kreis 1978
<i>Navicula lacustris</i> Gregory	Stoermer & Kreis 1978
<i>Navicula laevissima</i> Kützing	Stoermer & Kreis 1978
<i>Navicula laevissima</i> f. <i>fusticulus</i> (Østrup) Camburn	Camburn et al. 1978
<i>Navicula ladogensis</i> Cleve	Stoermer & Kreis 1978
<i>Navicula lagerheimii</i> Cleve	Stoermer 1962
<i>Navicula lagerheimii</i> var. <i>intermedia</i> Hustedt	Hohn & Helleman 1963
<i>Navicula lagerstedtii</i> Cleve	Patrick & Reimer 1966
<i>Navicula lalia</i> Hohn & Helleman	Hohn & Helleman 1963
<i>Navicula lanceolata</i> (Agardh) Kützing	Stoermer & Kreis 1978
<i>Navicula lanceolata</i> var. <i>cymbula</i> (Donkin) Cleve	Stoermer & Kreis 1978
<i>Navicula lanceolata</i> f. <i>minuta</i> Rabenhorst	Patrick & Reimer 1966
<i>Navicula lanceolata</i> var. <i>tenuirostris</i>	Stoermer et al. 1999
<i>Navicula lapidosa</i> Krasske	Collins & Kalinsky 1977
<i>Navicula lata</i> (Brébisson) Kützing	Elmore 1922
<i>Navicula latelongitudinalis</i> Patrick	Patrick 1959
<i>Navicula latens</i> Krasske	Stoermer & Kreis 1978

Name	Publication
<i>Navicula lateropunctata</i> Wallace	Stoermer & Kreis 1978
<i>Navicula laterostrata</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula latevittata</i> Cleve	Tempère & Peragallo 1908
<i>Navicula latissima</i> Gregory	Patrick & Reimer 1966
<i>Navicula legumen</i> Ehrenberg	Elmore 1922
<i>Navicula lenzii</i> Hustedt	Stoermer et al. 1999
<i>Navicula leptoceros</i>	Ehrenberg 1856
<i>Navicula leptogongyla</i> Ehrenberg	Kalinsky 1983
<i>Navicula leptorhynchus</i> Ehrenberg	Patrick & Reimer 1966
<i>Navicula leptosigma</i> Ehrenberg	Patrick & Reimer 1966
<i>Navicula leptostriata</i> Jorgensen	Dixit & Smol 1995
<i>Navicula leptotermia</i>	Ehrenberg 1856
<i>Navicula levanderi</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula liburnica</i> Grunow	Elmore 1922
<i>Navicula limosa</i> Kützing	Stoermer & Kreis 1978
<i>Navicula limosa</i> var. <i>gibberula</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Navicula limosa</i> var. <i>subinflata</i> Grunow	Stoermer & Kreis 1978
<i>Navicula limosa</i> var. <i>undulata</i> Grunow	Stoermer & Kreis 1978
<i>Navicula lineolata</i>	Ehrenberg 1856
<i>Navicula lirata</i> Ehrenberg	Patrick & Reimer 1966
<i>Navicula litos</i> Hohn & Hellerman	Camburn 1982
<i>Navicula longa</i> Ralfs	Stoermer & Kreis 1978
<i>Navicula longicephala</i> Hustedt	Johansen et al 1983
<i>Navicula longirostris</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula lucidula</i> Grunow	Patrick & Reimer 1966
<i>Navicula ludloviana</i> A. Schmidt	Boyer 1927b
<i>Navicula lundstroemii</i> Cleve	Stoermer & Kreis 1978
<i>Navicula luzonensis</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula lyra</i> Ehrenberg	Hohn 1951
<i>Navicula lyra</i> var. <i>elliptica</i> A. Schmidt	Patrick & Reimer 1966
<i>Navicula macilenta</i> Cleve	Tempère & Peragallo 1909
<i>Navicula maculata</i> var. <i>lanceolata</i> Heiden	Patrick & Reimer 1966
<i>Navicula maculata</i> var. <i>orbiculata</i> Patrick	Patrick & Reimer 1966
<i>Navicula major</i> Kützing	Stoermer & Kreis 1978
<i>Navicula major</i> var. <i>asymetrica</i>	Tempère & Peragallo 1909
<i>Navicula major</i> var. <i>dilatata</i> M. Peragallo	Patrick & Reimer 1966
<i>Navicula major</i> var. <i>maxima</i>	Patrick & Reimer 1966
<i>Navicula mandumensis</i> Jorgensen	Camburn & Charles 2000
<i>Navicula margaritaceae</i> Hustedt	Johansen et al. 1983
<i>Navicula maxima</i> Gregory	Stoermer & Kreis 1978
<i>Navicula meandrinoidea</i> Hustedt	Hustedt 1930
<i>Navicula mediocris</i> Krasske	Stoermer & Kreis 1978
<i>Navicula mediocris</i> var. <i>intermedia</i> Reimer	Reimer 1966
<i>Navicula mediocomplexa</i> Hohn & Hellerman	Patrick & Reimer 1966
<i>Navicula mediahelos</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula medioconvexa</i> Hustedt	Potapova & Charles 2002
<i>Navicula megaloptera</i> Ehrenberg	Tempère & Peragallo 1908
<i>Navicula menisculoidea</i> Hustedt	Stoermer et al. 1999
<i>Navicula menisculus</i> Schumann	Stoermer & Kreis 1978
<i>Navicula menisculus</i> var. <i>krenneri</i> A. Cleve	Stoermer et al. 1999
<i>Navicula menisculus</i> f. <i>linearis</i> Reimer	Reimer 1970
<i>Navicula meniscula</i> var. <i>muralis</i> (Grunow) Lange-Bertalot	Yearsley et al. 1992
<i>Navicula menisculus</i> var. <i>obtusa</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula menisculus</i> var. <i>upsaliensis</i> (Grunow) Grunow	Camburn 1982
<i>Navicula meniscus</i> Schumann	Stoermer et al. 1999
<i>Navicula mesogongyla</i> Ehrenberg	Kalinsky 1983
<i>Navicula mesogongyla</i> var. <i>interrupta</i> Cleve	Tempère & Peragallo 1908

Name	Publication
<i>Navicula mesolepta</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula mesolepta</i> var. <i>stauroneiformis</i> Grunow	Tempère & Peragallo 1908
<i>Navicula mesostyla</i> Ehrenberg	Tempère & Peragallo 1908
<i>Navicula mica</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula micropupula</i> Cholnoky	Stoermer & Kreis 1978
<i>Navicula microstauron</i> var. <i>stauroneiformis</i>	Tempère & Peragallo 1909
<i>Navicula migma</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula minima</i> Grunow	Stoermer & Kreis 1978
<i>Navicula minima</i> var. <i>atomoides</i> (Grunow) Cleve	Patrick 1945
<i>Navicula minima</i> var. <i>okamurae</i> Skvortzow	Stoermer & Kreis 1978
<i>Navicula minima</i> var. <i>pseudofossilis</i> (Krasske) Reimer	Reimer 1966
<i>Navicula minnewaukonensis</i> Elmore	Stoermer & Kreis 1978
<i>Navicula minthe</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula minuscula</i> Grunow	Stoermer & Kreis 1978
<i>Navicula minuscula</i> f. <i>linearis</i> Reimer	Reimer 1970
<i>Navicula minuscula</i> var. <i>alpestris</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula minusculoides</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula minuta</i>	Patrick & Reimer 1966
<i>Navicula mobiliensis</i> Boyer	Collins & Kalinsky 1977
<i>Navicula mobiliensis</i> var. <i>minor</i> Patrick	Patrick 1959
<i>Navicula modica</i> Hustedt	Camburn & Charles 2000
<i>Navicula molestiformis</i> Hustedt	Grimes & Rushforth 1982
<i>Navicula monmouthiana-stodderi</i> Yermeloff	Boyer 1927b
<i>Navicula monoculata</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula montana</i> Moghadam	Prescott & Dillard 1979
<i>Navicula mournei</i> Patrick	Patrick 1959
<i>Navicula mucronata</i> Elmore	Elmore 1922
<i>Navicula multigramme</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula muraliformis</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula muralis</i> Grunow	Patrick 1945
<i>Navicula murrayi</i> West & West	Rushforth & Merkley 1988
<i>Navicula muscerda</i> Hohn	Patrick & Reimer 1966
<i>Navicula mutica</i> Kützing	Stoermer & Kreis 1978
<i>Navicula mutica</i> var. <i>binodis</i> Hustedt	Camburn 1982
<i>Navicula mutica</i> var. <i>cohnii</i> (Hilse) Grunow	Stoermer & Kreis 1978
<i>Navicula mutica</i> var. <i>gibbosa</i> McCall	Collins & Kalinsky 1977
<i>Navicula mutica</i> var. <i>goeppertiana</i> (Bleisch) Grunow	Collins & Kalinsky 1977
<i>Navicula mutica</i> f. <i>intermedia</i> Hustedt	Reimer 1970
<i>Navicula mutica</i> var. <i>nivalis</i> (Ehrenberg) Hustedt	Stoermer & Kreis 1978
<i>Navicula mutica</i> var. <i>stigma</i> Patrick	Patrick 1959
<i>Navicula mutica</i> var. <i>tropica</i> Hustedt	Collins & Kalinsky 1977
<i>Navicula mutica</i> var. <i>tropica</i> f. <i>rostrata</i> Krasske	Lowe & Kocielek 1984
<i>Navicula mutica</i> var. <i>undulata</i> (Hilse) Grunow	Stoermer & Kreis 1978
<i>Navicula mutica</i> var. <i>ventricosa</i> Kützing	Hohn 1951
<i>Navicula mutica</i> f. <i>lanceolata</i> Frenguelli	Camburn 1982
<i>Navicula muticoides</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula muticopsis</i> Van Heurck	Stoermer & Kreis 1978
<i>Navicula narinosa</i> Hohn	Patrick & Reimer 1966
<i>Navicula naumannii</i> Hustedt	Camburn & Charles 2000
<i>Navicula nemoris</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula neoventricosa</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula nigrii</i> de Notaris	Collins & Kalinsky 1977
<i>Navicula nimbus</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula nivalis</i> Ehrenberg	Collins & Kalinsky 1977
<i>Navicula nobilis</i> (Ehrenberg) Kützing	Stoermer & Kreis 1978
<i>Navicula nobilis</i> var. <i>dactylus</i> (Ehrenberg) Van Heurck	Myers 1898b
<i>Navicula nodosa</i> Ehrenberg	Elmore 1922

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<i>Navicula nodosa</i> f. <i>curta</i> Rabenhorst	Tempère & Peragallo 1908
<i>Navicula nodulosa</i> Kützing	Cleve & Möller 1879
<i>Navicula nolens</i> Simonsen	Kalinsky 1983
<i>Navicula notha</i> Wallace	Stoermer & Kreis 1978
<i>Navicula nugalis</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula nyassensis</i> O. Müller	Stoermer & Kreis 1978
<i>Navicula nyassensis</i> var. <i>capitata</i> O. Müller	Hohn & Hellerman 1963
<i>Navicula nyassensis</i> f. <i>minor</i> O. Müller	Stoermer & Kreis 1978
<i>Navicula obdurata</i> Hohn & Hellerman	Stoermer & Kreis 1978
<i>Navicula oblonga</i> (Kützing) Kützing	Stoermer & Kreis 1978
<i>Navicula oblongata</i> Kützing	Patrick & Reimer 1966
<i>Navicula oblongiformis</i> Hustedt	Hustedt 1934
<i>Navicula oblongum</i> var. <i>subcapitata</i> Pantocsek	Stoermer & Kreis 1978
<i>Navicula obsidialis</i> Hustedt	Reimer 1970
<i>Navicula obsoleta</i> Hustedt	Reimer 1970
<i>Navicula obtusa</i>	Ehrenberg 1856
<i>Navicula obtuseprotracta</i>	Hustedt 1966
<i>Navicula ocellii</i> Hohn	Patrick & Reimer 1966
<i>Navicula oculata</i> Krasske	Patrick & Reimer 1966
<i>Navicula odiosa</i> Wallace	Stoermer & Kreis 1978
<i>Navicula ohiensis</i> Ehrenberg	Patrick & Reimer 1966
<i>Navicula okadae</i> (Skvortzow) Nagumo & Kobayasi	Camburn & Charles 2000
<i>Navicula omissa</i> Hustedt	Collins & Kalinsky 1977
<i>Navicula opportuna</i> Hustedt	Stoermer et al. 1999
<i>Navicula oppugnata</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula orangiana</i> Patrick	Patrick 1959
<i>Navicula orbiculata</i> Patrick	Patrick 1959
<i>Navicula ordinaria</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula oregonica</i>	Ehrenberg 1856
<i>Navicula oxigua</i> (Gregory) Müller	Patrick & Reimer 1966
<i>Navicula paanaensis</i> A. Cleve	Stoermer & Kreis 1978
<i>Navicula paca</i> Hohn & Hellerman	Stoermer & Kreis 1978
<i>Navicula pachyptera</i> Ehrenberg	Tempère & Peragallo 1908
<i>Navicula palpebralis</i> Brébisson	Elmore 1922
<i>Navicula paludosa</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula paludosa</i> f. <i>rhomboidea</i> Reimer	Reimer 1970
<i>Navicula paludosa</i> var. <i>rhomboidea</i> Hustedt	Collins & Kalinsky 1977
<i>Navicula pampeana</i> Frenguelli	Stoermer 1964
<i>Navicula parablis</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula paramutica</i> Bock	Rushforth & Merkley 1988
<i>Navicula paramutica</i> var. <i>binodis</i> Bock	Lawson & Rushforth 1975
<i>Navicula parasubtilissima</i> Kobayasi & Nagumo	Camburn & Charles 2000
<i>Navicula paratunkae</i> Peterson	Camburn 1982
<i>Navicula parodia</i> Hohn	Patrick & Reimer 1966
<i>Navicula parva</i> Ralfs	Stoermer & Kreis 1978
<i>Navicula parva</i> (Ehrenberg) Elmore	Elmore 1922
<i>Navicula parva</i> (Meneghin) Cleve	Kaczmarek & Rushforth 1983
<i>Navicula paucivisitata</i> Patrick	Patrick 1959
<i>Navicula paulensis</i> Grunow	Tempère & Peragallo 1913
<i>Navicula pavillardii</i> Hustedt	Kalinsky 1983
<i>Navicula pelliculosa</i> Hilse	Stoermer & Kreis 1978
<i>Navicula pennata</i> A. Schmidt	Patrick & Reimer 1966
<i>Navicula pennsylvanica</i> Patrick	Patrick & Reimer 1966
<i>Navicula peratomus</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula peregrina</i> (Ehrenberg) Kützing	Stoermer & Kreis 1978
<i>Navicula peregrina</i> var. <i>truncata</i> M. Peragallo in Tempère & Peragallo	Tempère & Peragallo 1908
<i>Navicula peripunctata</i> J. Brun	Tempère & Peragallo 1908

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<i>Navicula permitis</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula perpusilla</i> Grunow	Stoermer & Kreis 1978
<i>Navicula perpusilla</i> var. <i>distans</i> Cleve-Euler	Patrick & Reimer 1966
<i>Navicula perrotettii</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Navicula perrotettii</i> var. <i>enervis</i> Hustedt	Stoermer et al. 1999
<i>Navicula perventralis</i> Hustedt	Patrick & Reimer 1966
<i>Navicula peticolasii</i> M. Peragallo	Patrick & Reimer 1966
<i>Navicula phyllodes</i>	Ehrenberg 1856
<i>Navicula placenta</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula placentula</i> (Ehrenberg) Kützing	Stoermer & Kreis 1978
<i>Navicula placentula</i> var. <i>jenisseyensis</i> (Grunow) Meister	Hohn 1951
<i>Navicula placentula</i> var. <i>latiuscula</i> (Grunow) Meister	Drum 1981
<i>Navicula placentula</i> var. <i>maculata</i> Hustedt	Stoermer et al. 1999
<i>Navicula placentula</i> var. <i>rostrata</i> A. Mayer	Stoermer & Kreis 1978
<i>Navicula placentula</i> f. <i>rostrata</i> A. Mayer	Camburn 1982
<i>Navicula platalea</i> Ehrenberg	Patrick & Reimer 1966
<i>Navicula platycephala</i> O. Müller	Stoermer & Kreis 1978
<i>Navicula platysoma</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula platysoma</i> var. <i>pantocsekii</i> Wislough & Kolbe	Stoermer & Kreis 1978
<i>Navicula platyventris</i> Meister	Kalinsky 1983
<i>Navicula pletura</i> Hohn	Patrick & Reimer 1966
<i>Navicula poconoensis</i> Patrick	Patrick 1945
<i>Navicula pollis</i>	Van Heurck & Grunow 1882-1885 (#544)
<i>Navicula polyonca</i> Brebissona	Aubert 1895
<i>Navicula polystricta</i> var. <i>circumstricta</i> Grunow	Collins & Kalinsky 1977
<i>Navicula porifera</i> var. <i>opposita</i> (Hustedt) Lange-Bertalot	Stoermer et al. 1999
<i>Navicula portomontana</i> Cleve	Bateman & Rushforth 1984
<i>Navicula potzgeri</i> Reimer	Stoermer & Kreis 1978
<i>Navicula potzgeri</i> var. <i>quadripunctata</i> Reimer	Patrick & Reimer 1966
<i>Navicula praeterita</i> Hustedt	Stoermer et al. 1999
<i>Navicula pragma</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula producta</i> W. Smith	Stoermer & Kreis 1978
<i>Navicula protracta</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Navicula protracta</i> var. <i>elliptica</i> Gallik	Stoermer & Kreis 1978
<i>Navicula protracta</i> f. <i>subcapitata</i> (Wils. & Por.) Hustedt	Stoermer & Kreis 1978
<i>Navicula pseuanglica</i> Lange-Bertalot	Stoermer et al. 1999
<i>Navicula pseudoarvensis</i> Hustedt	Camburn et al. 1978
<i>Navicula pseudoatomus</i> Lund	Loescher 1981
<i>Navicula pseudobacillum</i> Grunow	Stoermer & Kreis 1978
<i>Navicula pseudocanal</i>	Patrick & Roberts 1979
<i>Navicula pseudoclementis</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula pseudocrassirostris</i> Hustedt	Kaczmarek & Rushforth 1983
<i>Navicula pseudoexillissima</i> Hustedt	Fee 1967
<i>Navicula pseudofrickia</i> Patrick	Patrick & Reimer 1966
<i>Navicula pseudolanceolata</i> Lange-Bertalot	Siver et al. 2005
<i>Navicula pseudomuralis</i> Hustedt	Stoermer et al. 1999
<i>Navicula pseudopelliculosa</i> Manguin	Hohn & Hellerman 1963
<i>Navicula pseudoreinhardtii</i> Patrick	Stoermer & Kreis 1978
<i>Navicula pseudoscutiformis</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula pseudosilicula</i> Hustedt	Bateman & Rushforth 1984
<i>Navicula pseudosilicula</i> var. <i>olympica</i> Sovereign	Patrick & Reimer 1966
<i>Navicula pseudosubtilissima</i> Manguin	Camburn & Charles 2000
<i>Navicula pseudotuscula</i> Hustedt	Grimes & Rushforth 1982
<i>Navicula pseudoventralis</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula punctata</i> Donkin	Stoermer & Kreis 1978
<i>Navicula pupula</i> Kützing	Stoermer & Kreis 1978
<i>Navicula pupula</i> var. <i>aquaeductae</i> (Krasske) Hustedt	Stoermer & Kreis 1978

Name	Publication
<i>Navicula pupula</i> var. <i>bacillarioides</i> Grunow	Stoermer & Kreis 1978
<i>Navicula pupula</i> var. <i>capitata</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula pupula</i> var. <i>elliptica</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula pupula</i> var. <i>lineare</i> Tempère & Peragallo	Tempère & Peragallo 1908
<i>Navicula pupula</i> var. <i>major</i> O. Müller	Patrick & Reimer 1966
<i>Navicula pupula</i> var. <i>minor</i> Kützing	Tempère & Peragallo 1908
<i>Navicula pupula</i> f. <i>minor</i>	Tempère & Peragallo 1909
<i>Navicula pupula</i> f. <i>minuta</i>	Tempère & Peragallo 1909
<i>Navicula pupula</i> var. <i>minuta</i> Van Heurck	Clark & Rushforth 1977
<i>Navicula pupula</i> f. <i>minutula</i> Cholnoky	Hohn & Hellerman 1963
<i>Navicula pupula</i> var. <i>mutata</i> (Krasske) Hustedt	Stoermer & Kreis 1978
<i>Navicula pupula</i> var. <i>rectangularis</i> (Gregory) Cleve	Stoermer & Kreis 1978
<i>Navicula pupula</i> var. <i>rostrata</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula pupula</i> f. <i>rostrata</i> Hustedt	Camburn 1982
<i>Navicula pusilla</i> W. Smith	Stoermer & Kreis 1978
<i>Navicula pusilla</i> var. <i>lanceolata</i> (Grunow) Grunow	Patrick & Reimer 1966
<i>Navicula pusio</i> Cleve	Prescott & Dillard 1979
<i>Navicula pygmaea</i> Kützing	Stoermer & Kreis 1978
<i>Navicula quadripartita</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula rabenhorstii</i> Ralfs	Aubert 1895
<i>Navicula radians</i>	Patrick & Reimer 1966
<i>Navicula radiosa</i> Kützing	Stoermer & Kreis 1978
<i>Navicula radiosa</i> var. <i>acuta</i> Grunow	Tempère & Peragallo 1908
<i>Navicula radiosa</i> var. <i>parva</i> Wallace	Stoermer & Kreis 1978
<i>Navicula radiosa</i> var. <i>subrostrata</i> Cleve	Patrick & Reimer 1966
<i>Navicula radiosa</i> var. <i>tenella</i> (Brébisson) Grunow	Stoermer & Kreis 1978
<i>Navicula radiosafallax</i> Lange-Bertalot	Stoermer et al. 1999
<i>Navicula rainierensis</i> Sovereign	Patrick & Reimer 1966
<i>Navicula rangoonensis</i> (Grunow) Elmore	Elmore 1922
<i>Navicula recava</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula recens</i> Lange-Bertalot	Potapova & Charles 2003
<i>Navicula recondita</i> Torika	Stoermer & Kreis 1978
<i>Navicula reichardtiana</i> Lange-Bertalot	Potapova & Charles 2003
<i>Navicula reinhardtii</i> Grunow	Stoermer & Kreis 1978
<i>Navicula reinhardtii</i> var. <i>elliptica</i> Héribaud	Stoermer & Kreis 1978
<i>Navicula retusa</i> var. <i>elongata</i>	Patrick & Reimer 1966
<i>Navicula rhodana</i> Hohn & Hellerman	Patrick & Reimer 1966
<i>Navicula rhomboides</i> Grunow	Stoermer & Kreis 1978
<i>Navicula rhomboides</i> var. <i>major</i>	Cleve & Möller 1879
<i>Navicula rhynchocephala</i> Kützing	Stoermer & Kreis 1978
<i>Navicula rhynchocephala</i> var. <i>amphiceros</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Navicula rhynchocephala</i> var. <i>germainii</i> (Wallace) Patrick	Stoermer & Kreis 1978
<i>Navicula rhynchotella</i> Lange-Bertalot	Stoermer et al. 1999
<i>Navicula rivalis</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula rostellata</i> Kützing	Stoermer & Kreis 1978
<i>Navicula rostrata</i> Ehrenberg	Elmore 1922
<i>Navicula rotaeana</i> (Rabenhorst) Grunow	Stoermer & Kreis 1978
<i>Navicula rotaeana</i> var. <i>excentrica</i> Grunow	Stoermer & Kreis 1978
<i>Navicula rotunda</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula rugula</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula rupestris</i> Hantzsch	Myers 1898b
<i>Navicula ruttneri</i> Hustedt	Sovereign 1958
<i>Navicula sabiniana</i> Patrick	Stoermer & Kreis 1978
<i>Navicula sagitta</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula salinarum</i> Grunow	Stoermer & Kreis 1978
<i>Navicula salinarum</i> var. <i>capitata</i> Schulz	Kaczmarek & Rushforth 1983
<i>Navicula salinarum</i> var. <i>intermedia</i> (Grunow) Cleve	Stoermer & Kreis 1978

Name	Publication
<i>Navicula salinicola</i> Hustedt	Potapova & Charles 2003
<i>Navicula sanctaecrucis</i> Østrup	Camburn 1982
<i>Navicula saphrophila</i> Lange-Bertalot & Bonik	Johansen et al. 1983
<i>Navicula saugerii</i> Desm.	Stoermer & Kreis 1978
<i>Navicula savannahiana</i> Patrick	Camburn 1982
<i>Navicula scalprum</i>	Ehrenberg 1856
<i>Navicula schadei</i> Krasske	Camburn & Charles 2000
<i>Navicula schmassmannii</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula schoenfeldii</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula schroeteri</i> Meister	Hohn & Hellerman 1963
<i>Navicula schroeteri</i> var. <i>escambia</i> Patrick	Stoermer & Kreis 1978
<i>Navicula schumanniana</i> Grunow	Stoermer & Kreis 1978
<i>Navicula schweinfurthii</i> A. Schmidt	Aubert 1895
<i>Navicula sculpta</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula scutelloides</i> W. Smith	Stoermer & Kreis 1978
<i>Navicula scutelloides</i> var. <i>minutissima</i>	Tempère & Peragallo 1909
<i>Navicula scutelloides</i> var. <i>mocarensis</i> Grunow	Patrick & Reimer 1966
<i>Navicula scutiformis</i> Grunow	Stoermer & Kreis 1978
<i>Navicula scutula</i> Hohn	Patrick & Reimer 1966
<i>Navicula scutum</i> Schumann	Patrick & Reimer 1966
<i>Navicula secreta</i> Pantocsek	Stoermer & Kreis 1978
<i>Navicula secreta</i> Patrick	Stoermer & Kreis 1978
<i>Navicula secreta</i> var. <i>apiculata</i> Patrick	Camburn 1982
<i>Navicula semen</i> (Ehrenberg) Donkin	Boyer 1927b
<i>Navicula semenoides</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula seminuloides</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula seminuloides</i> var. <i>sumatrana</i> Hustedt	Sovereign 1958
<i>Navicula seminulum</i> Grunow	Stoermer & Kreis 1978
<i>Navicula seminulum</i> var. <i>hustedtii</i> Patrick	Camburn 1982
<i>Navicula seminulum</i> var. <i>intermedia</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula septata</i> Hustedt	Rushforth & Merkley 1988
<i>Navicula septenaria</i> L.W. Bailey	Patrick & Reimer 1966
<i>Navicula serians</i> Kützing	Stoermer & Kreis 1978
<i>Navicula serians</i> var. <i>foliis</i> Ehrenberg	Cleve & Möller 1879
<i>Navicula serians</i> var. <i>minor</i>	Tempère & Peragallo 1911
<i>Navicula sigma</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula silicula</i> Ehrenberg	Elmore 1922
<i>Navicula similis</i> Krasske	Stoermer & Kreis 1978
<i>Navicula simplex</i> Krasske	Camburn 1982
<i>Navicula simula</i> Patrick	Patrick 1959
<i>Navicula singularis</i> Schmidt	Cleve & Möller 1878
<i>Navicula skabitschewskyi</i> Sabelina	Stoermer & Kreis 1978
<i>Navicula skalenastriata</i> Hohn	Patrick & Reimer 1966
<i>Navicula spirata</i> Hustedt	Collins & Kalinsky 1977
<i>Navicula splendicula</i> Van Ledingham	Camburn 1982
<i>Navicula smithii</i> Brébisson	Stoermer & Kreis 1978
<i>Navicula smithii</i> var. <i>dilatata</i> M. Peragallo in Tempère & Pergallo	Tempère & Peragallo 1908
<i>Navicula sohrensis</i> Krasske	Bateman & Rushforth 1984
<i>Navicula sohrensis</i> var. <i>hassiaci</i> (Krasske) Lange-Bertalot	Camburn & Charles 2000
<i>Navicula sorella</i> Hohn & Hellerman	Patrick & Reimer 1966
<i>Navicula soveraignae</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula speciosa</i> Hustedt	Hustedt 1913
<i>Navicula sphaerophora</i> Kützing	Stoermer & Kreis 1978
<i>Navicula spicula</i> (Hickie) Cleve	Kalinsky 1983
<i>Navicula splendicula</i> Van Ledingham	Stoermer et al. 1999
<i>Navicula stankovici</i> Hustedt	Patrick & Reimer 1966
<i>Navicula staurifera</i> Thomas	Stoermer & Kreis 1978

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<i>Navicula stauroneiformis</i> Elmore	Patrick & Reimer 1966
<i>Navicula stauroptera</i> Ralfs	Tempère & Peragallo 1912
<i>Navicula stauroptera</i> var. <i>parva</i> (Ehrenberg) Grunow	Stoermer & Kreis 1978
<i>Navicula stauroptera</i> var. <i>troiana</i> Grunow	Cleve & Möller 1879
<i>Navicula stodderi</i> Greenl.	Cleve 1894
<i>Navicula stomatophora</i> Grunow	Tempère & Peragallo 1908
<i>Navicula strenzkei</i> Hustedt.	Grimes & Rushforth 1982
<i>Navicula stroemii</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula stroesei</i> (Østrup) Cleve	Stoermer & Kreis 1978
<i>Navicula subacuta</i> Ehrenberg	Tempère & Peragallo 1909
<i>Navicula subadnata</i> Hustedt	Lawson & Rushforth 1975
<i>Navicula subarvensis</i> Hustedt.	Dodd 1987
<i>Navicula subatomoides</i> Hustedt.	Patrick 1945
<i>Navicula subbacillum</i> Hustedt	Collins & Kalinsky 1977
<i>Navicula subcapitata</i> (Gregory) Ralfs	Elmore 1922
<i>Navicula subcapitata</i> var. <i>stauroneiformis</i>	Tempère & Peragallo 1908
<i>Navicula subclementis</i> Hustedt.	Stoermer & Kreis 1978
<i>Navicula subcontenta</i> Hustedt.	Reimer 1990
<i>Navicula subcostulata</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula subfasciata</i> Patrick	Patrick 1959
<i>Navicula subgastriformis</i> Hustedt	Stoermer et al. 1999
<i>Navicula subhalophila</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula subhamulata</i> Grunow	Stoermer & Kreis 1978
<i>Navicula subhamulata</i> var. <i>undulata</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula subhexagona</i> Hustedt.	Hustedt 1934
<i>Navicula subinflata</i> Grunow	Patrick & Reimer 1966
<i>Navicula subinflatooides</i> Hustedt	Czarnecki et al. 1981
<i>Navicula sunminuscula</i> Manguin	Hohn & Hellerman 1963
<i>Navicula submitis</i> Hustedt.	Stoermer et al. 1999
<i>Navicula submolesta</i> Hustedt	Patrick & Reimer 1966
<i>Navicula submuralis</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula subocculata</i> Hustedt.	Stoermer & Kreis 1978
<i>Navicula subrhynchocephala</i> Hustedt.	Stoermer & Kreis 1978
<i>Navicula subrotundata</i> Hustedt.	Stoermer & Kreis 1978
<i>Navicula subrotundata</i> f. <i>lanceolata</i> Hustedt	Stoermer et al. 1999
<i>Navicula subseminulum</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula subsulcata</i> Hustedt.	Stoermer & Kreis 1978
<i>Navicula subsulcatoides</i> Hustedt	Kaczmarek & Rushforth 1983
<i>Navicula subtilissima</i> Cleve	Stoermer & Kreis 1978
<i>Navicula suchlandtii</i> Hustedt	Lowe & Kociolek 1984
<i>Navicula swaniana</i> Moghadam	Prescott & Dillard 1979
<i>Navicula symmetrica</i> Patrick	Stoermer & Kreis 1978
<i>Navicula tabellaria</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula tabellaria</i> var. <i>stauroneiformis</i>	Aubert 1895
<i>Navicula taedia</i> Wallich	Patrick & Reimer 1966
<i>Navicula tantula</i> Hustedt.	Stoermer & Kreis 1978
<i>Navicula tantula</i> var. <i>minima</i> Grunow	Collins & Kalinsky 1977
<i>Navicula taraxa</i> Hohn & Hellerman	Kalinsky 1983
<i>Navicula tecta</i> Krasske	Stoermer & Kreis 1978
<i>Navicula tenella</i> (Brébisson) Van Heurck.	Stoermer & Kreis 1978
<i>Navicula tenelloides</i> Hustedt	Collins & Kalinsky 1977
<i>Navicula tenera</i> Hustedt.	Collins & Kalinsky 1977
<i>Navicula tenuicephala</i> Hustedt	Dixit & Smol 1995
<i>Navicula termes</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula terminata</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula terrestris</i> Petersen	Dodd 1987
<i>Navicula terrestris</i> var. <i>relicta</i> f. <i>triundulata</i> Lund	Dodd 1987

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<i>Navicula texana</i> Patrick	Stoermer & Kreis 1978
<i>Navicula thermes</i> (Ehrenberg) A. Schmidt	Elmore 1922
<i>Navicula thienemannii</i> Hustedt	Reimer 1966
<i>Navicula tracery</i> Hohn & Hellerman	Patrick & Reimer 1966
<i>Navicula transversa</i> A. Schmidt	Tempère & Peragallo 1908
<i>Navicula tridentula</i> Krasske	Stoermer & Kreis 1978
<i>Navicula tridentula</i> var. <i>parallela</i> Krasske	Stoermer & Kreis 1978
<i>Navicula trinodis</i> Lewis	Stoermer & Kreis 1978
<i>Navicula tripunctata</i> (O.F. Müller) Bory	Stoermer & Kreis 1978
<i>Navicula tripunctata</i> var. <i>cuneata</i> (Lauby) Stoermer & Yang	Stoermer & Kreis 1978
<i>Navicula tripunctata</i> var. <i>schizonemoides</i> (Van Heurck) Patrick	Stoermer & Kreis 1978
<i>Navicula trivialis</i> Lange-Bertalot	Yearsely et al. 1992
<i>Navicula trochus</i> Schumann	Stoermer & Kreis 1978
<i>Navicula tulugakii</i> Carter	Rushforth & Merkle 1988
<i>Navicula tumida</i> W. Smith	Stoermer & Kreis 1978
<i>Navicula tuscula</i> Ehrenberg	Stoermer & Kreis 1978
<i>Navicula tuscula</i> var. <i>angulata</i> Hustedt	Stoermer et al. 1999
<i>Navicula tuscula</i> var. <i>rostrata</i> (Hustedt) Hustedt	Stoermer et al. 1999
<i>Navicula tuscula</i> f. <i>minor</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula tuscula</i> f. <i>obtusa</i> (Hustedt) Hustedt	Stoermer & Kreis 1978
<i>Navicula tuscula</i> f. <i>rostrata</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula typografica</i> Hustedt	Hustedt 1930
<i>Navicula umbra</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula utermohleii</i> Hustedt	Prescott & Dillard 1979
<i>Navicula vanheurckii</i> Patrick	Stoermer & Kreis 1978
<i>Navicula varians</i> Gregory	Stoermer & Kreis 1978
<i>Navicula variostrata</i> Krasske	Stoermer & Kreis 1978
<i>Navicula vaucheriae</i> J.B. Petersen	Stoermer et al. 1999
<i>Navicula venerabilis</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Navicula veneta</i> Kützing	Johansen et al. 2004
<i>Navicula ventosa</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula ventralis</i> Krasske	Stoermer & Kreis 1978
<i>Navicula ventralis</i> var. <i>chilensis</i> Krasske	Hohn & Hellerman 1963
<i>Navicula ventralis</i> f. <i>simplex</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula ventricosa</i> Kützing	Tempère & Peragallo 1908
<i>Navicula ventricosa</i> var. <i>undulata</i>	Tempère & Peragallo 1909
<i>Navicula verecunda</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula vetita</i> Krasske	Dodd 1971
<i>Navicula viridis</i> (Nitzsch) Ehrenberg	Stoermer & Kreis 1978
<i>Navicula viridis</i> var. <i>fallax</i> Cleve	Tempère & Peragallo 1908
<i>Navicula viridis</i> var. <i>commutata</i> Grunow	Tempère & Peragallo 1908
<i>Navicula viridula</i> (Kützing) Ehrenberg	Stoermer & Kreis 1978
<i>Navicula viridula</i> var. <i>argunensis</i> Skvortzow	Collins & Kalinsky 1977
<i>Navicula viridula</i> var. <i>avenacea</i> (Brébisson) Van Heurck	Stoermer & Kreis 1978
<i>Navicula viridula</i> var. <i>germainii</i> (J.H. Wallace) Lange-Bertalot	Lange-Bertalot 1993
<i>Navicula viridula</i> var. <i>linearis</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula viridula</i> var. <i>rostellata</i> (Kützing) Cleve	Stoermer & Kreis 1978
<i>Navicula vitabunda</i> Hustedt	Stoermer & Kreis 1978
<i>Navicula vitabunda</i> var. <i>montana</i> Moghadam	Prescott & Dillard 1979
<i>Navicula vitiosa</i> Schimanski	Camburn & Charles 2000
<i>Navicula vulpina</i> Kützing	Stoermer & Kreis 1978
<i>Navicula vulpina</i> var. <i>avenacea</i> (Van Heurck) Patrick	Stoermer et al. 1999
<i>Navicula walkeri</i> Sovereign	Patrick & Reimer 1966
<i>Navicula wallacei</i> Reimer	Camburn 1982
<i>Navicula wardii</i> Patrick	Patrick 1959
<i>Navicula wittrockii</i> (Lagerstedt) Tempère & M. Peragallo	Stoermer & Kreis 1978
<i>Navicula wulffi</i> Boye Peterson	Hohn & Hellerman 1963

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<i>Navicula yarrensis</i> Grunow	Kalinsky 1983
<i>Navicula yorkensis</i> Camburn	Camburn 1982
<i>Navicula zanoni</i> Hustedt	Stoermer & Kreis 1978
<i>Neidium affine</i> (Ehrenberg) Pfitzer	Stoermer & Kreis 1978
<i>Neidium affine</i> var. <i>amphirhynchus</i> (Ehrenberg) Cleve	Stoermer & Kreis 1978
<i>Neidium affine</i> var. <i>bonsaensis</i> Foged	Lowe 1972-1973
<i>Neidium affine</i> var. <i>capitata</i> Molder	Stoermer et al. 1999
<i>Neidium affine</i> var. <i>ceylonicum</i> (Skvortzow) Reimer	Stoermer & Kreis 1978
<i>Neidium affine</i> var. <i>genuinum</i> f. <i>maxima</i> Cleve	Boyer 1927b
<i>Neidium affine</i> var. <i>hankense</i> (Skvortzow) Reimer	Stoermer & Kreis 1978
<i>Neidium affine</i> var. <i>humerus</i> Reimer	Stoermer & Kreis 1978
<i>Neidium affine</i> var. <i>longiceps</i> (Gregory) Cleve	Camburn 1982
<i>Neidium affine</i> var. <i>quadripunctatum</i> (Hustedt) Hamilton	Camburn & Charles 2000
<i>Neidium affine</i> var. <i>tenuirostris</i> A. Mayer	Stoermer 1963
<i>Neidium affine</i> var. <i>undulatum</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Neidium alpinum</i> Hustedt	Patrick & Reimer 1966
<i>Neidium alpinum</i> var. <i>quadripunctatum</i> (Hustedt) Hamilton	Hamilton et al. 1990
<i>Neidium amphigomphus</i> (Ehrenberg) Pfitzer	Stoermer & Kreis 1978
<i>Neidium amphirhynchus</i> (Ehrenberg) Boyer	Boyer 1927b
<i>Neidium ampliatum</i> (Ehrenberg) Krammer	Stoermer et al. 1999
<i>Neidium apiculatum</i> Reimer	Stoermer & Kreis 1978
<i>Neidium apiculatum</i> var. <i>constrictum</i> Reimer	Patrick & Reimer 1966
<i>Neidium binode</i> (Ehrenberg) Hustedt	Stoermer & Kreis 1978
<i>Neidium bisulcatum</i> (Lagestedt) Cleve	Stoermer & Kreis 1978
<i>Neidium bisulcatum</i> var. <i>baicalense</i> (Skvortzow & Meyer) Reimer	Stoermer & Kreis 1978
<i>Neidium bisulcatum</i> f. <i>lineare</i> (Østrup) Cleve-Euler	Bateman & Rushforth 1984
<i>Neidium bisulcatum</i> var. <i>nipponicum</i> Skvortzow	Patrick & Reimer 1966
<i>Neidium bisulcatum</i> var. <i>subundulatum</i> (Grunow) Reimer	Camburn 1982
<i>Neidium bisulcatum</i> f. <i>undulata</i> (O. Müller) Hustedt	Bateman & Rushforth 1984
<i>Neidium bisulcatum</i> var. <i>undulatum</i> O. Müller	Patrick 1945
<i>Neidium boyeri</i> Reimer	Patrick & Reimer 1966
<i>Neidium calvum</i> Østrup	Stoermer & Kreis 1978
<i>Neidium cape-codii</i> Siver & Hamilton in Siver et al.	Siver et al. 2003
<i>Neidium decens</i> (Pantocsek) Stoermer	Stoermer 1963
<i>Neidium densestriatum</i> (Østrup) Krammer	Hamilton et al. 1992
<i>Neidium dilatatum</i> (Ehrenberg) Cleve	Boyer 1927b
<i>Neidium distincte-punctatum</i> Hustedt	Stoermer & Kreis 1978
<i>Neidium dubium</i> (Ehrenberg) Cleve	Stoermer & Kreis 1978
<i>Neidium dubium</i> f. <i>constrictum</i> Hustedt	Stoermer & Kreis 1978
<i>Neidium floridanum</i> Reimer	Patrick & Reimer 1966
<i>Neidium gracile</i> f. <i>aequale</i> Hustedt	Patrick & Reimer 1966
<i>Neidium hankensis</i> Skvortzow	Stoermer 1963
<i>Neidium hankensis</i> var. <i>elongata</i> Skvortzow	Stoermer 1963
<i>Neidium hercynicum</i> A. Mayer	Camburn 1982
<i>Neidium hercynicum</i> f. <i>subrostratum</i> Wallace	Camburn 1982
<i>Neidium herrmannii</i> Hustedt	Patrick & Reimer 1966
<i>Neidium hitchcockii</i> (Ehrenberg) Cleve	Stoermer & Kreis 1978
<i>Neidium hitchcockii</i> f. <i>teres</i> Sovereign	Patrick & Reimer 1966
<i>Neidium holstii</i> (Cleve) Krammer	Camburn & Charles 2000
<i>Neidium inconstans</i> Sovereign	Patrick & Reimer 1966
<i>Neidium iridis</i> (Ehrenberg) Cleve	Stoermer & Kreis 1978
<i>Neidium iridis</i> var. <i>amphigomphus</i> (Ehrenberg) A. Mayer	Stoermer & Kreis 1978
<i>Neidium iridis</i> var. <i>ampliatum</i> (Ehrenberg) Cleve	Stoermer & Kreis 1978
<i>Neidium iridis</i> var. <i>conspicua</i> A. Mayer	Patrick & Reimer 1966
<i>Neidium iridis</i> var. <i>intercedens</i> A. Mayer	Schmidt & Fee 1967
<i>Neidium iridis</i> var. <i>subundulatum</i> (Cleve-Euler) Reimer	Patrick & Reimer 1966
<i>Neidium iridis</i> var. <i>vernalis</i> Reichelt	Stoermer & Kreis 1978

Name	Publication
<i>Neidium knuthii</i> var. <i>heilprinensis</i> Foged	Patrick & Reimer 1966
<i>Neidium kozolwi</i> Mereschkowsky	Stoermer & Kreis 1978
<i>Neidium kozolwi</i> var. <i>baicalensis</i> f. <i>robusta</i> Stoermer	Stoermer & Kreis 1978
<i>Neidium kozlowii</i> var. <i>parvum</i> Mereschkowsky	Patrick & Reimer 1966
<i>Neidium kozlowi</i> var. <i>undulata</i> Stoermer	Stoermer 1963
<i>Neidium ladogensis</i> (Cleve) Stoermer & Yang	Stoermer & Kreis 1978
<i>Neidium ladogensis</i> var. <i>densestriatum</i> (Østrup) Foged	Camburn 1982
<i>Neidium ladogensis</i> var. <i>densestriatum</i> f. <i>peribryum</i> Lowe & Kociolek	Lowe & Kociolek 1984
<i>Neidium levanderi</i> (Hustedt) Lange-Bertalot & Metzeltin	Stoermer et al. 1999
<i>Neidium magellanicum</i> Cleve	Prescott & Dillard 1979
<i>Neidium maximum</i> (Cleve) Meister	Patrick & Reimer 1966
<i>Neidium mirum</i> Krasske	Stoermer et al. 1999
<i>Neidium muncikii</i> Foged	Lowe 1972–1973
<i>Neidium productum</i> (W. Smith) Cleve	Stoermer & Kreis 1978
<i>Neidium rudimentarum</i> Reimer	Patrick & Reimer 1966
<i>Neidium saccoense</i> Reimer	Stoermer & Kreis 1978
<i>Neidium temperei</i> Reimer	Stoermer & Kreis 1978
<i>Neidium tenuissimum</i> Hustedt	Johansen et al. 1983
<i>Neidium tumescens</i> (Grunow) Cleve	Boyer 1927b
<i>Nitzschia abbreviata</i> Hustedt	Collins & Kalinsky 1977
<i>Nitzschia abridia</i> Camburn	Camburn 1982
<i>Nitzschia accedens</i> Hustedt	Hohn & Hellerman 1963
<i>Nitzschia accomodata</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia acicularioides</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia acicularis</i> (Kützing) W. Smith	Stoermer & Kreis 1978
<i>Nitzschia acicularis</i> var. <i>adelos</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Nitzschia acicularis</i> <i>closterioides</i> Grunow	Czarnecki & Blinn 1978
<i>Nitzschia acida</i> Camburn	Johansen et al. 2004
<i>Nitzschia acidoclinata</i> Lange-Bertalot	Stoermer et al. 1999
<i>Nitzschia actinastroides</i> (Lemmerman) Van Goor	Stoermer & Kreis 1978
<i>Nitzschia acula</i> Hantzsch	Dodd 1987
<i>Nitzschia acuminata</i> (W. Smith) Grunow	Stoermer & Kreis 1978
<i>Nitzschia acuta</i> Hantzsch	Stoermer & Kreis 1978
<i>Nitzschia acutiuscula</i> Grunow	Tempère & Peragallo 1909
<i>Nitzschia adamata</i> Hustedt	Hansmann 1973
<i>Nitzschia adapta</i> Hustedt	Collins & Kalinsky 1977
<i>Nitzschia admissoides</i> Cholnoky	Collins & Kalinsky 1977
<i>Nitzschia aerophila</i> Hustedt	Potapova & Charles 2002
<i>Nitzschia agnewii</i> Cholnoky	Stoermer & Kreis 1978
<i>Nitzschia agnita</i> Hustedt	Collins & Kalinsky 1977
<i>Nitzschia amphibioides</i> Hustedt	Camburn et al. 1978
<i>Nitzschia amphibia</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia amphibia</i> var. <i>fossilis</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia amphibia</i> var. <i>frauenfeldii</i> Grunow	Stoermer et al. 1999
<i>Nitzschia amphicephala</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia amphioxoides</i> Hustedt	Stoermer et al. 1999
<i>Nitzschia amphioxys</i> (Ehrenberg) W. Smith	Stoermer & Kreis 1978
<i>Nitzschia amplexans</i> Hustedt	Camburn 1982
<i>Nitzschia angularis</i> var. <i>affinis</i> Grunow	Benson & Rushforth 1975
<i>Nitzschia angustata</i> (W. Smith) Grunow	Stoermer & Kreis 1978
<i>Nitzschia angustata</i> var. <i>acuta</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia angustulata</i> Lange-Bertalot	Stoermer et al. 1999
<i>Nitzschia apiculata</i> (Gregory) Grunow	Stoermer & Kreis 1978
<i>Nitzschia archibaldii</i> Lange-Bertalot	Potapova & Charles 2002
<i>Nitzschia aurariae</i> Cholnoky	Potapova & Charles 2002
<i>Nitzschia asymbasia</i> Hohn	Hohn 1961

Name	Publication
<i>Nitzschia bacata</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia bacata</i> f. <i>linearis</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia bacillariaeformis</i>	Collins & Kalinsky 1977
<i>Nitzschia bacillariaeformis</i> var. <i>producta</i> Cholnoky	Collins & Kalinsky 1977
<i>Nitzschia balcanica</i> Hustedt	Johansen et al. 1983
<i>Nitzschia bella</i> Sovereign	Sovereign 1963
<i>Nitzschia bergii</i> A. Cleve	Czarnecki et al. 1981
<i>Nitzschia biacricula</i> Hohn & Hellerman	Camburn 1982
<i>Nitzschia bicrena</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Nitzschia bilobata</i> var. <i>ambigua</i> Manguin	Kalinsky 1983
<i>Nitzschia bita</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Nitzschia brebissonii</i> W. Smith	Boyer 1927b
<i>Nitzschia bremensis</i> Hustedt	Collins & Kalinsky 1977
<i>Nitzschia brevisrostris</i> Hustedt	Collins & Kalinsky 1977
<i>Nitzschia brevissima</i> (Grunow) Kalinsky	Camburn 1982
<i>Nitzschia bryophila</i> Hustedt	Reimer 1990
<i>Nitzschia bulnheimiana</i> (Rabenhorst) H.L. Smith	Stoermer & Kreis 1978
<i>Nitzschia bulnheimiana</i> var. <i>capitata</i> Reimer	Reimer 1966
<i>Nitzschia caledonensis</i> Schoeman	Dodd 1987
<i>Nitzschia calida</i> Grunow	Camburn 1982
<i>Nitzschia capitellata</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia chasei</i> Cholnoky	Collins & Kalinsky 1977
<i>Nitzschia circumscuta</i> (Bailey) Grunow	Stoermer et al. 1999
<i>Nitzschia clausii</i> Hantzsch	Stoermer & Kreis 1978
<i>Nitzschia closterium</i> (Ehrenberg) W. Smith	Stoermer & Kreis 1978
<i>Nitzschia coarctata</i> Grunow	Camburn 1982
<i>Nitzschia columbiana</i> Sovereign	Sovereign 1958
<i>Nitzschia communis</i> Rabenhorst	Stoermer & Kreis 1978
<i>Nitzschia communis</i> var. <i>abbreviata</i> Grunow	Collins & Kalinsky 1977
<i>Nitzschia communis</i> var. <i>hyalina</i> Lund	Reimer 1970
<i>Nitzschia communis</i> var. <i>obtusa</i> Grunow	Reimer 1961
<i>Nitzschia commutata</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia compressa</i> (Bailey) Boyer	Collins & Kalinsky 1977
<i>Nitzschia confinis</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia congolensis</i> Hustedt	Wujek & Rupp 1980
<i>Nitzschia congolensis</i> var. <i>mooreae</i> Reimer	Reimer 1982
<i>Nitzschia constricta</i> (Kützing) Ralfs	Camburn 1982
<i>Nitzschia constricta</i> var. <i>subconstricta</i> Grunow	Camburn 1982
<i>Nitzschia debilis</i> Arnott ex Grunow	Camburn 1982
<i>Nitzschia debilis</i> H.L. Smith	H.L. Smith 1876-1888 (#690)
<i>Nitzschia delicatissima</i> Cleve	Stoermer & Kreis 1978
<i>Nitzschia denticula</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia denticula</i> var. <i>aberrans</i> Fusey	Reimer 1961
<i>Nitzschia desertorum</i> Hustedt	Collins & Kalinsky 1977
<i>Nitzschia diserta</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia dissipata</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Nitzschia dissipata</i> var. <i>borneensis</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia dissipata</i> var. <i>media</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia dissipata</i> f. <i>undulata</i> Sovereign	Camburn 1982
<i>Nitzschia draveillensis</i> Coste & Ricard	Stoermer et al. 1999
<i>Nitzschia dubia</i> W. Smith	Stoermer & Kreis 1978
<i>Nitzschia elegans</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia elegantula</i> Grunow	Camburn 1982
<i>Nitzschia elliptica</i> Hustedt	Collins & Kalinsky 1977
<i>Nitzschia epiphytica</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia epiphyticoides</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia epithemioides</i> Grunow	Rushforth & Squires 1985

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<i>Nitzschia etoshensis</i> Cholnoky	Collins & Kalinsky 1977
<i>Nitzschia exilis</i> Sovereign	Sovereign 1958
<i>Nitzschia fasciculata</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia filiformis</i> (W. Smith) Schutt	Stoermer & Kreis 1978
<i>Nitzschia filiformis</i> var. <i>conferta</i> (P.G. Richter) Lange-Bertalot	Stoermer et al. 1999
<i>Nitzschia flexa</i> Schumann	Stoermer & Kreis 1978
<i>Nitzschia fluminensis</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia fonticola</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia fonticola</i> var. <i>capitata</i> A. Cleve	Stoermer & Kreis 1978
<i>Nitzschia fonticola</i> var. <i>pelagica</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia fonticola</i> var. <i>romana</i> (Grunow) Cleve-Euler	Whitford & Schumacher 1973
<i>Nitzschia fonticoloides</i> Sovereign	Stoermer & Kreis 1978
<i>Nitzschia frequens</i> Hustedt	Collins & Kalinsky 1977
<i>Nitzschia frustulum</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Nitzschia frustulum</i> var. <i>indica</i>	Patrick 1968
<i>Nitzschia frustulum</i> var. <i>minutula</i>	Stoermer et al. 1999
<i>Nitzschia frustulum</i> var. <i>perminuta</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia frustulum</i> var. <i>perpusilla</i> (Rabenhorst) Grunow	Stoermer & Kreis 1978
<i>Nitzschia frustulum</i> var. <i>subsalina</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia frustulum</i> var. <i>subserians</i>	Patrick & Roberts 1979
<i>Nitzschia frustulum</i> var. <i>tenella</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia gandersheimiensis</i> Krasske	Stoermer & Kreis 1978
<i>Nitzschia geitleri</i> Hustedt	Dodd 1987
<i>Nitzschia gessneri</i> Hustedt	Stoermer et al. 1999
<i>Nitzschia graciliformis</i> Lange-Bertalot & Simonsen	Stoermer et al. 1999
<i>Nitzschia graciloides</i> Hustedt	Stoermer et al. 1999
<i>Nitzschia gracilis</i> Hantzsch	Stoermer & Kreis 1978
<i>Nitzschia gracilis</i> var. <i>minor</i>	Patrick 1968
<i>Nitzschia gracilis</i> var. <i>schizonemoides</i> Van Heurck	Starrett & Patrick 1952
<i>Nitzschia hantzschiana</i> Rabenhorst	Stoermer & Kreis 1978
<i>Nitzschia hantzschiana</i> f. <i>subserians</i> Grunow	Patrick 1945
<i>Nitzschia hennedyi</i> W. Smith	Whitford & Schumacher 1973
<i>Nitzschia heufleuriana</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia hiemalis</i> Hustedt	Reimer 1961
<i>Nitzschia hollerupensis</i> Foged	Stoermer et al. 1999
<i>Nitzschia holsatica</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia hamburgiensis</i> Lange-Bertalot	Stoermer et al. 1999
<i>Nitzschia hungarica</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia hustediana</i> Salah	Rushforth et al. 1986
<i>Nitzschia hybrida</i> Grunow	Czarnecki & Blinn 1978
<i>Nitzschia ignorata</i> Krasske	Stoermer & Kreis 1978
<i>Nitzschia impressa</i> Hustedt	Stoermer et al. 1999
<i>Nitzschia incomptus</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Nitzschia inconspicua</i> Grunow	Stoermer et al. 1999
<i>Nitzschia incurvata</i> var. <i>lorenziana</i> R. Ross	Stoermer et al. 1999
<i>Nitzschia innominata</i> Sovereign	Stoermer et al. 1999
<i>Nitzschia insecta</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia intermedia</i> Hantzsch	Stoermer & Kreis 1978
<i>Nitzschia intermissa</i> Hustedt	Collins & Kalinsky 1977
<i>Nitzschia interrupta</i> (Reichel) Hustedt	Stoermer & Kreis 1978
<i>Nitzschia invisitata</i> Hustedt	Dodd 1971
<i>Nitzschia kittonii</i> H. L. Smith	Hohn & Hellerman 1963
<i>Nitzschia kuetzingiana</i> Hilse	Stoermer & Kreis 1978
<i>Nitzschia kuetzingiana</i> var. <i>exilis</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia kuetzingioides</i> Hustedt	Stoermer et al. 1999
<i>Nitzschia kurzii</i> Rabenhorst	Collins & Kalinsky 1977
<i>Nitzschia laevis</i> Hustedt	Collins & Kalinsky 1977

Name	Publication
<i>Nitzschia lacunarum</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia lacuum</i> Lange-Bertalot	Stoermer et al. 1999
<i>Nitzschia lancettula</i> O. Müller	Sovereign 1958
<i>Nitzschia latens</i> Hustedt	Collins & Kalinsky 1977
<i>Nitzschia lauenburgiana</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia lesbia</i> Cholnoky	Collins & Kalinsky 1977
<i>Nitzschia levidensis</i> (W. Smith) Grunow	Camburn 1982
<i>Nitzschia levidensis</i> var. <i>victoriae</i> (Grunow) Cholnoky	Collins & Kalinsky 1977
<i>Nitzschia liebetruthii</i> Rabenhorst	Collins & Kalinsky 1977
<i>Nitzschia linearis</i> (Agardh) W. Smith	Stoermer & Kreis 1978
<i>Nitzschia linearis</i> f. <i>minuta</i>	Cleve & Möller 1879
<i>Nitzschia linearis</i> var. <i>tenuis</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Nitzschia littoralis</i> Grunow	Patrick 1961
<i>Nitzschia littoralis</i> var. <i>tergestina</i> Grunow	Czarnecki & Blinn 1978
<i>Nitzschia longissima</i> (Brébisson) Ralfs	Stoermer & Kreis 1978
<i>Nitzschia longissima</i> var. <i>closterium</i> (W. Smith) Van Heurck	Stoermer & Kreis 1978
<i>Nitzschia longissima</i> var. <i>reversa</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia longissima</i> f. <i>parva</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia lorenziana</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia lorenziana</i> var. <i>subtilis</i> Grunow	Camburn 1982
<i>Nitzschia luzonensis</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia macilentata</i> Gregory	Stoermer & Kreis 1978
<i>Nitzschia magnacarina</i> Hohn & Helleman	Collins & Kalinsky 1977
<i>Nitzschia manca</i> Hustedt	Hohn & Helleman 1963
<i>Nitzschia mediastalsis</i> Hohn & Helleman	Hohn & Helleman 1963
<i>Nitzschia mediocris</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia microcephala</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia microcephala</i> var. <i>elegantula</i> Grunow	Hohn & Helleman 1963
<i>Nitzschia migrans</i> Cleve	Collins & Kalinsky 1977
<i>Nitzschia minuta</i> Bleisch	Camburn 1982
<i>Nitzschia minutula</i> Grunow	Stoermer et al. 1999
<i>Nitzschia mollis</i> Hustedt	Collins & Kalinsky 1977
<i>Nitzschia monoensis</i> Kociolek & Herbst	Kociolek & Herbst 1992
<i>Nitzschia montanestrus</i> Camburn	Camburn 1982
<i>Nitzschia nana</i> Grunow	Potapova & Charles 2003
<i>Nitzschia nereidis</i> Cholnoky	Collins & Kalinsky 1977
<i>Nitzschia obligata</i> Archibald	Collins & Kalinsky 1977
<i>Nitzschia obsidialis</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia obtusa</i> W. Smith	Stoermer & Kreis 1978
<i>Nitzschia obtusa</i> var. <i>brevissima</i> Grunow	Dodd 1981
<i>Nitzschia obtusa</i> var. <i>nana</i> Grunow	Camburn 1982
<i>Nitzschia obtusa</i> var. <i>scalpelliformis</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia oregana</i> Sovereign	Clark & Rushforth 1977
<i>Nitzschia ovalis</i> Arnott	Collins & Kalinsky 1977
<i>Nitzschia palea</i> (Kützing) W. Smith	Stoermer & Kreis 1978
<i>Nitzschia palea</i> var. <i>debilis</i> (Kützing) Grunow	Patrick 1945
<i>Nitzschia palea</i> var. <i>sumatrana</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia palea</i> var. <i>tenuirostris</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia palea</i> var. <i>tropica</i> Hustedt	Collins & Kalinsky 1977
<i>Nitzschia paleacea</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia paleaformis</i> Hustedt	Drum 1981
<i>Nitzschia paleoides</i> Hustedt	Stoermer et al. 1999
<i>Nitzschia paradoxa</i> (Gmelin) Grunow	Stoermer & Kreis 1978
<i>Nitzschia parvula</i> W. Smith	Stoermer & Kreis 1978
<i>Nitzschia parvula</i> var. <i>terricola</i> Lund	Collins & Kalinsky 1977
<i>Nitzschia paxillifer</i> (O. F. Müller) Heiberg	Boyer 1927b
<i>Nitzschia perminuta</i> Grunow	Camburn 1982

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<i>Nitzschia perspicillata</i> Camburn	Camburn 1982
<i>Nitzschia perspicua</i> Sovereign	Sovereign 1963
<i>Nitzschia pertica</i> Hohn & Helleman	Hohn & Helleman 1963
<i>Nitzschia perversa</i> Grunow	Dodd 1987
<i>Nitzschia philippinarum</i> Hustedt	Stoermer et al. 1999
<i>Nitzschia pilum</i> Hustedt	Hansmann 1973
<i>Nitzschia plana</i> W. Smith	Hansmann 1973
<i>Nitzschia plana</i> var. <i>americana</i> Hustedt 1924	Hustedt 1924
<i>Nitzschia planctonica</i> Hustedt	Stoermer et al. 1999
<i>Nitzschia praetexta</i> Nitzsch	Whitford & Schumacher 1973
<i>Nitzschia pseudoamphioxys</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia pseudobacata</i> Cholnoky	Collins & Kalinsky 1977
<i>Nitzschia pseudofonticola</i> Hustedt	Collins & Kalinsky 1977
<i>Nitzschia pseudohybrida</i>	Patrick & Roberts 1979
<i>Nitzschia pseudosinuata</i> Hamilton & Laird	Hamilton et al. 2001
<i>Nitzschia pseudostagnum</i> Hustedt	Kaczmarek & Rushforth 1983
<i>Nitzschia pubens</i> Cholnoky	Collins & Kalinsky 1977
<i>Nitzschia pumila</i> Hustedt	Camburn 1982
<i>Nitzschia punctata</i> (Grunow) Grunow	Rushforth & Merkley 1988
<i>Nitzschia punctata</i> var. <i>elongata</i> Grunow	Rushforth & Merkley 1988
<i>Nitzschia punctata</i> var. <i>peragalli</i> Halden	Patrick 1961
<i>Nitzschia pura</i> Hustedt	Stoermer et al. 1999
<i>Nitzschia pusilla</i> (Kützing) Grunow emend Lange-Bertalot	Camburn 1982
<i>Nitzschia radícula</i> Hustedt	Stoermer et al. 1999
<i>Nitzschia radiosa</i> Kützing	Czarnecki & Blinn 1978
<i>Nitzschia rautenbachiae</i> Cholnoky	Camburn 1982
<i>Nitzschia recta</i> Hantzsch	Stoermer & Kreis 1978
<i>Nitzschia recta</i> var. <i>romana</i>	Collins & Kalinsky 1977
<i>Nitzschia rectiformis</i> Hustedt	Hohn 1961
<i>Nitzschia reimerii</i> Kociolek & Herbst	Kociolek & Herbst 1992
<i>Nitzschia regula</i> Hustedt	Patrick 1961
<i>Nitzschia reversa</i> W. Smith	Camburn 1982
<i>Nitzschia romana</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia romanoides</i> Manguin	Kalinsky 1983
<i>Nitzschia rostellata</i> Hustedt	Camburn 1982
<i>Nitzschia rufitorrentis</i> Cholnoky	Dodd 1987
<i>Nitzschia scalaris</i> (Ehrenberg) W. Smith	Stoermer & Kreis 1978
<i>Nitzschia scalaris</i> var. <i>undulata</i> Wolle	Tempère & Peragallo 1911
<i>Nitzschia semidesum</i> Hohn & Helleman	Hohn & Helleman 1963
<i>Nitzschia sentiformis</i> Hohn & Helleman	Hohn & Helleman 1963
<i>Nitzschia serpenticula</i> Cholnoky	Collins & Kalinsky 1977
<i>Nitzschia serpentiraphe</i> Lange-Bertalot	Lange-Bertalot 1993
<i>Nitzschia sicula</i> var. <i>migrans</i> (Cleve) Hasle	Stoermer & Kreis 1978
<i>Nitzschia sigma</i> (Kützing) W. Smith	Stoermer & Kreis 1978
<i>Nitzschia sigma</i> var. <i>diminuta</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia sigma</i> var. <i>rigida</i> (Kützing) Grunow	Stoermer et al. 1999
<i>Nitzschia sigma</i> var. <i>rigidula</i> Grunow	Hohn & Helleman 1963
<i>Nitzschia sigma</i> var. <i>sigmatella</i> (Gregory) Grunow	Stoermer & Kreis 1978
<i>Nitzschia sigmatella</i> Gregory	Boyer 1927b
<i>Nitzschia sigmaformis</i> Hustedt	Camburn 1982
<i>Nitzschia sigmoidea</i> (Nitzsch) W. Smith	Stoermer & Kreis 1978
<i>Nitzschia silicula</i> Hustedt	Czarnecki et al. 1981
<i>Nitzschia silicula</i> var. <i>commutata</i> Reimer	Reimer 1966
<i>Nitzschia silicula</i> var. <i>migrans</i>	Patrick & Roberts 1979
<i>Nitzschia siliqua</i> Archibald	Collins & Kalinsky 1977
<i>Nitzschia sinuata</i> W. Smith	Stoermer & Kreis 1978
<i>Nitzschia sinuata</i> var. <i>delongnei</i> (Grunow) Lange-Bertalot	Stoermer et al. 1999

Name	Publication
<i>Nitzschia sinuata</i> var. <i>tabellaria</i> (Grunow) Grunow	Stoermer & Kreis 1978
<i>Nitzschia sociabilis</i> Hustedt	Camburn 1982
<i>Nitzschia socialis</i> Gregory	Rushforth & Merkle 1988
<i>Nitzschia solita</i> Hustedt	Potapova & Charles 2002
<i>Nitzschia speciosa</i> Hustedt	Lowe 1972–1973
<i>Nitzschia spectabilis</i> (Ehrenberg) Ralfs	Collins & Kalinsky 1977
<i>Nitzschia spectabilis</i> var. <i>americana</i> Grunow	Boyer 1927b
<i>Nitzschia sphaerophora</i> A. Cleve	Stoermer & Kreis 1978
<i>Nitzschia spiculoides</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia spiculum</i> Hustedt	Collins & Kalinsky 1977
<i>Nitzschia stagnicola</i> Rabenhorst	Kalinsky 1983
<i>Nitzschia stagnorum</i> Rabenhorst	Stoermer & Kreis 1978
<i>Nitzschia steynii</i> Cholnoky	Collins & Kalinsky 1977
<i>Nitzschia stricta</i> Hustedt	Collins & Kalinsky 1977
<i>Nitzschia subacicularis</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia subamphioxoides</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia subcapitellata</i> Hustedt	Stoermer et al. 1999
<i>Nitzschia subconfinis</i> Cholnoky	Reimer 1982
<i>Nitzschia sublinearis</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia subrostrata</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia subrostratoides</i> Cholnoky	Collins & Kalinsky 1977
<i>Nitzschia subrostroides</i> Cholnoky	Stoermer et al. 1999
<i>Nitzschia subtilis</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Nitzschia subtilis</i> var. <i>paleacea</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia subvitrea</i> Hustedt	Dodd 1987
<i>Nitzschia suchlandtii</i> Hustedt	Potapova & Charles 2002
<i>Nitzschia supralitoria</i> Lange-Bertalot	Potapova & Charles 2003
<i>Nitzschia tabellaria</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia tarda</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia tenuis</i> W. Smith	Stoermer & Kreis 1978
<i>Nitzschia terricola</i> Lund	Camburn et al. 1978
<i>Nitzschia thermalis</i> (Ehrenberg) Auerswald	Stoermer & Kreis 1978
<i>Nitzschia thermalis</i> var. <i>dubia</i>	Collins & Kalinsky 1977
<i>Nitzschia thermalis</i> var. <i>intermedia</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia thermalis</i> var. <i>minor</i> Hilse	Stoermer & Kreis 1978
<i>Nitzschia tonoensis</i> Foged	Hansmann 1973
<i>Nitzschia tropica</i> Hustedt	Stoermer & Kreis 1978
<i>Nitzschia tryblionella</i> Hantzsch	Stoermer & Kreis 1978
<i>Nitzschia tryblionella</i> var. <i>calida</i> (Grunow) Van Heurck	Hohn & Helleman 1963
<i>Nitzschia tryblionella</i> var. <i>debilis</i> (Arnott) A. Mayer	Stoermer & Kreis 1978
<i>Nitzschia tryblionella</i> var. <i>levidensis</i> (W. Smith) Grunow	Stoermer & Kreis 1978
<i>Nitzschia tryblionella</i> var. <i>maxima</i> Grunow	Camburn et al. 1978
<i>Nitzschia tryblionella</i> var. <i>salinarum</i> Grunow	Hohn & Helleman 1963
<i>Nitzschia tryblionella</i> var. <i>victoriae</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia umbilicata</i> Hustedt	Collins & Kalinsky 1977
<i>Nitzschia umbonata</i> (Ehrenberg) Lange-Bertalot	Dodd 1987
<i>Nitzschia valdestriata</i> Aleem & Hustedt	Camburn 1982
<i>Nitzschia valga</i> Cholnoky	Collins & Kalinsky 1977
<i>Nitzschia vermicularis</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Nitzschia vexans</i> Grunow	Stoermer & Kreis 1978
<i>Nitzschia vitrea</i> Norman	Stoermer & Kreis 1978
<i>Nitzschia vitrea</i> var. <i>major</i>	Tempère & Peragallo 1909
<i>Nitzschia vitrea</i> var. <i>recta</i> (Hantzsch) Van Heurck	Tilden 1894–1909 (#94)
<i>Nitzschia vitrea</i> var. <i>scaphiformis</i> Wislough & Poretzky	Dodd 1987
<i>Nitzschia vivax</i> W. Smith	Boyer 1927b
<i>Nitzschia vonhauseniae</i> Cholnoky	Collins & Kalinsky 1977
<i>Nitzschia volcanica</i> Sovereign	Sovereign 1958

Name	Publication
<i>Nitzschia vulga</i> Cholnoky	Stoermer et al. 1999
<i>Nitzschia wiplingeri</i> Cholnoky	Collins & Kalinsky 1977
<i>Nitzschia woltereckii</i> Hustedt.	Stoermer & Kreis 1978
<i>Nitzschia zuzulandica</i> Cholnoky	Collins & Kalinsky 1977
<i>Nupela carolina</i> Potapova & Clason 2003	Potapova et al. 2003
<i>Nupela neglecta</i> Ponader, Lowe & Potapova 2003.	Potapova et al. 2003
<i>Nupela neotropica</i> Lange-Bertalot in Lange-Bertalot & Moser	Siver et al. 2005
<i>Nupela paludigena</i> (Scherer) Lange-Bertalot	Lange-Bertalot 1993
<i>Nupela vitiosa</i> (Schimanski) Lange-Bertalot.	Siver et al. 2005
<i>Nupela wellneri</i> (Lange-Bertalot) Lange-Bertalot	Potapova et al. 2003
<i>Odontella polymorpha</i>	Ehrenberg 1856
<i>Odontidium anceps</i> Ehrenberg.	Patrick 1945
<i>Odontidium elongatum</i> (Agardh) Kuntze	Elmore 1922
<i>Odontidium hiemale</i> (Roth) Heiberg	Stoermer & Kreis 1978
<i>Odontidium hiemale</i> var. <i>mesodon</i> (Ehrenberg) Grunow	Patrick 1945
<i>Odontidium mesodon</i> Mutzing.	Aubert 1895
<i>Odontidium mutabile</i> W. Smith	Stoermer & Kreis 1978
<i>Odontidium tabellaria</i> Lewis	Aubert 1895
<i>Odontidium vulgare</i> (Bory) Elmore	Elmore 1922
<i>Oestrupia bicontracta</i> (Østrup) Lange-Bertalot & Krammer.	Stoermer et al. 1999
<i>Oestrupia zachariasi</i> (Reichelt) Stoermer & Yang	Stoermer & Kreis 1978
<i>Oestrupia zachariasi</i> var. <i>undulata</i> (Schultz) Stoermer & Yang	Stoermer & Kreis 1978
<i>Opephora americana</i> M. Peragallo	Patrick & Reimer 1966
<i>Opephora ansata</i> Hohn & Hellerman	Stoermer & Kreis 1978
<i>Opephora martyi</i> Héribaud	Stoermer & Kreis 1978
<i>Opephora martyi</i> var. <i>capitata</i> (Héribaud) Hustedt.	Sovereign 1958
<i>Opephora olsenii</i> Möller.	Morales 2001
<i>Opephora pacifica</i> Petit	Prescott & Dillard 1979
<i>Opephora pinnata</i> Ehrenberg	Stoermer & Kreis 1978
<i>Opephora schulzi</i> (Brockmann) Simons	Czarnecki et al. 1981
<i>Opephora swartzii</i> (Grunow) Petit.	Prescott & Dillard 1979
?? <i>Orthoseira dendroteres</i> (Ehrenberg) Crawford	Gaiser & Johansen 2000
?? <i>Orthosira dickiei</i> Thwaites	Stoermer & Kreis 1978
?? <i>Orthosira orichalcea</i>	Collins & Kalinsky 1977
?? <i>Orthoseira roseana</i> (Rabenhorst) O'Meara	Hamilton et al. 1992
<i>Oxyneis binalis</i> (Ehrenberg) Round in Round et al.	Siver et al. 2005
<i>Peronia fibula</i> (Brébisson ex Kützing) Ross.	Patrick & Reimer 1966
<i>Peronia heribaudi</i> Brun ex M. Peragallo in Héribaud.	Hamilton et al. 1992
<i>Peronia intermedium</i> (H.L. Smith) Patrick.	Patrick & Reimer 1966
<i>Pinnularia abaujensis</i> (Pantocsek) Ross	Stoermer & Kreis 1978
<i>Pinnularia abaujensis</i> var. <i>lacustris</i> Camburn & Charles	Camburn & Charles 2000
<i>Pinnularia abaujensis</i> var. <i>linearis</i> (Hustedt) Patrick	Stoermer & Kreis 1978
<i>Pinnularia abaujensis</i> var. <i>rostrata</i> (Patrick) Patrick	Camburn 1982
<i>Pinnularia abaujensis</i> var. <i>subundulata</i> (A. Mayer) Patrick	Stoermer & Kreis 1978
<i>Pinnularia absita</i> Hohn & Hellerman	Patrick & Reimer 1966
<i>Pinnularia acrosphaeria</i> W. Smith.	Stoermer & Kreis 1978
<i>Pinnularia acrosphaeria</i> f. <i>genuina</i> Cleve	Cleve 1895
<i>Pinnularia acrosphaeria</i> var. <i>laevis</i> (M. Peragallo & Héribaud) Cleve	Patrick & Reimer 1966
<i>Pinnularia acrosphaeria</i> var. <i>turgidula</i> Grunow ex Cleve.	Camburn 1982

Name	Publication
<i>Pinnularia acuminata</i> W. Smith	Patrick & Reimer 1966
<i>Pinnularia acuminata</i> var. <i>bielawski</i> (Héribaud & Peragallo) Patrick	Collins & Kalinsky 1977
<i>Pinnularia acuminata</i> var. <i>instabilis</i> (A. Schmidt) Patrick	Patrick & Reimer 1966
<i>Pinnularia acuminata</i> var. <i>interrupta</i> (Cleve) Patrick	Patrick & Reimer 1966
<i>Pinnularia acuta</i>	Ehrenberg 1856
<i>Pinnularia aequalis</i>	Ehrenberg 1856
<i>Pinnularia aequalateralis</i> Patrick & Freese	Stoermer 1964
<i>Pinnularia aestuariae</i> Cleve	Krammer 2000
<i>Pinnularia aestuariae</i> var. <i>interrupta</i> (Hustedt) Cleve-Euler	Bateman & Rushforth 1984
<i>Pinnularia affinis</i>	Ehrenberg 1856
<i>Pinnularia alabamae</i> Krammer	Krammer 2000
<i>Pinnularia alpina</i> W. Smith	Krammer 2000
<i>Pinnularia alpina</i> var. <i>elongata</i> (M. Peragallo & Héribaud) Mills	Patrick & Reimer 1966
<i>Pinnularia amblyos</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Pinnularia amphigomphus</i>	Ehrenberg 1856
<i>Pinnularia amphioxys</i> Ehrenberg	Stoermer & Kreis 1978
<i>Pinnularia amphisbaena</i>	Ehrenberg 1856
<i>Pinnularia amphistylus</i> Ehrenberg	Rushforth & Merkley 1988
<i>Pinnularia anglica</i> Krammer	Gaiser & Johansen 2000
<i>Pinnularia appendiculata</i> (Agardh) Cleve	Boyer 1927b
<i>Pinnularia aquilonaris</i> Hohn & Hellerman	Patrick & Reimer 1966
<i>Pinnularia balfouriana</i>	Patrick & Roberts 1979
<i>Pinnularia biceps</i> Gregory	Stoermer & Kreis 1978
<i>Pinnularia biceps</i> var. <i>minor</i> (Petersen) Cleve-Euler	Rushforth & Merkley 1988
<i>Pinnularia biceps</i> f. <i>petersenii</i> Ross	Stoermer & Kreis 1978
<i>Pinnularia biceps</i> var. <i>pusilla</i> Camburn & Charles	Camburn & Charles 2000
<i>Pinnularia bigibba</i> Gaiser & Johansen	Gaiser & Johansen 2000
<i>Pinnularia bihastata</i> (A. Mann) Patrick	Hansmann 1973
<i>Pinnularia bogotensis</i> (Grunow) Cleve	Boyer 1927b
<i>Pinnularia bogotensis</i> var. <i>undulata</i> (Peragallo) Boyer	Patrick & Reimer 1966
<i>Pinnularia borealis</i> Ehrenberg	Stoermer & Kreis 1978
<i>Pinnularia borealis</i> var. <i>brevicostata</i> Hustedt	Collins & Kalinsky 1977
<i>Pinnularia borealis</i> var. <i>caraccana</i> (Ehrenberg) Brun	Patrick & Reimer 1966
<i>Pinnularia borealis</i> var. <i>congolensis</i> Zanon	Loescher 1981
<i>Pinnularia borealis</i> var. <i>rectangularis</i> Carlson	Stoermer & Kreis 1978
<i>Pinnularia borealis</i> var. <i>scalaris</i> (Ehrenberg) Rabenhorst	Gaiser & Johansen 2000
<i>Pinnularia borealis</i> var. <i>subacuta</i> Ehrenberg	Patrick & Reimer 1966
<i>Pinnularia borealis</i> var. <i>truncata</i> Ehrenberg	Patrick & Reimer 1966
<i>Pinnularia boyeri</i> Patrick	Patrick & Reimer 1966
<i>Pinnularia bramanorum</i>	Ehrenberg 1856
<i>Pinnularia brandelii</i> Cleve	Stoermer & Kreis 1978
<i>Pinnularia brauniana</i> (Grunow ex Schmidt) F.W. Mills	Hamilton et al. 1992
<i>Pinnularia braunii</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Pinnularia braunii</i> var. <i>amphicephala</i> (A. Mayer) Hustedt	Stoermer & Kreis 1978
<i>Pinnularia braunii</i> var. <i>amphicephala</i> f. <i>subconica</i> Venkataraman	Camburn & Charles 2000
<i>Pinnularia brebissonii</i> (Kützing) Rabenhorst	Stoermer & Kreis 1978
<i>Pinnularia brebissonii</i> f. <i>biundulata</i> O. Müller	Lawson & Rushforth 1975
<i>Pinnularia brebissonii</i> var. <i>diminuta</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Pinnularia brebissonii</i> var. <i>notata</i> Héribaud & Peragallo	Cleve 1895
<i>Pinnularia brevicostata</i> Cleve	Stoermer & Kreis 1978
<i>Pinnularia brevicostata</i> var. <i>leptostauron</i> Cleve	Tiffany & Britton 1952
<i>Pinnularia burkii</i> Patrick	Stoermer & Kreis 1978
<i>Pinnularia capitata</i>	Ehrenberg 1856
<i>Pinnularia cardinaliculis</i> Cleve	Stoermer & Kreis 1978
<i>Pinnularia cardinalis</i> (Ehrenberg) W. Smith	Stoermer & Kreis 1978
<i>Pinnularia carolinensis</i>	Ehrenberg 1856
<i>Pinnularia castor</i> Hohn & Hellerman	Patrick & Reimer 1966

Name	Publication
<i>Pinnularia caudata</i> (Boyer) Patrick	Camburn 1982
<i>Pinnularia cherryfieldiana</i> Krammer	Krammer 2000
<i>Pinnularia clevei</i> Patrick	Patrick 1945
<i>Pinnularia cocconeis</i> Ehrenberg	Stoermer & Kreis 1978
<i>Pinnularia conspicua</i> (A. Schmidt) Cleve	Patrick & Reimer 1966
<i>Pinnularia convexa</i> Sovereign	Patrick & Reimer 1966
<i>Pinnularia cooperi</i> J.W. Bailey	Ehrenberg 1856
<i>Pinnularia crucifera</i> var. <i>subrostrata</i> A. Cleve	Clark & Rushforth 1977
<i>Pinnularia cumvibia</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Pinnularia cuneicephala</i> (Mann) Patrick	Patrick & Reimer 1966
<i>Pinnularia dactylus</i> Ehrenberg	Stoermer & Kreis 1978
<i>Pinnularia dactylus</i> var. <i>dariana</i> (A. Schmidt) Cleve	Boyer 1927b
<i>Pinnularia dactylus</i> var. <i>demerarae</i> Cleve	Boyer 1927b
<i>Pinnularia decurrans</i> Ehrenberg	Patrick & Reimer 1966
<i>Pinnularia dicephala</i> (Ehrenberg) W. Smith	Ehrenberg 1856
<i>Pinnularia digitus</i>	Ehrenberg 1856
<i>Pinnularia disphenia</i>	Ehrenberg 1856
<i>Pinnularia distinguenda</i> Cleve	Stoermer & Kreis 1978
<i>Pinnularia divergens</i> W. Smith	Stoermer & Kreis 1978
<i>Pinnularia divergens</i> var. <i>bacillaris</i> (M. Peragallo) Mills	Stoermer & Kreis 1978
<i>Pinnularia divergens</i> var. <i>decrescens</i> (Grunow) Krammer	Gaiser & Johansen 2000
<i>Pinnularia divergens</i> var. <i>elliptica</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Pinnularia divergens</i> var. <i>parallela</i> (Brun) Patrick	Camburn 1982
<i>Pinnularia divergens</i> var. <i>schweinfurthii</i> (A. Schmidt) Cleve	Boyer 1927b
<i>Pinnularia divergens</i> var. <i>sublinearis</i> Cleve	Boyer 1927b
<i>Pinnularia divergens</i> var. <i>undulata</i> (M. Peragallo & Héribaldi) Hustedt	Patrick & Reimer 1966
<i>Pinnularia divergentissima</i> (Grunow) Cleve	Patrick 1946
<i>Pinnularia divergentissima</i> f. <i>elongata</i> Cleve-Euler	Patrick 1946
<i>Pinnularia divergitissima</i> var. <i>subrostrata</i> A. Cleve	Siver et al. 2005
<i>Pinnularia doloma</i> Hohn & Hellerman	Patrick & Reimer 1966
<i>Pinnularia dubitabilis</i> Hustedt	Czarnecki & Blinn 1978
<i>Pinnularia elliptica</i>	Ehrenberg 1856
<i>Pinnularia elongata</i> Hustedt	Hustedt 1934
<i>Pinnularia episcopalis</i> Cleve	Boyer 1927b
<i>Pinnularia episcopalis</i> var. <i>subelliptica</i> A. Cleve	Lawson & Rushforth 1975
<i>Pinnularia erratica</i> var. <i>fossilis</i> Krammer	Krammer 2000
<i>Pinnularia esox</i> Cleve	Boyer 1927b
<i>Pinnularia esoxiformes</i> Fusey	Gaiser & Johansen 2000
<i>Pinnularia falaiseana</i> Krammer	Gaiser & Johansen 2000
<i>Pinnularia fasciata</i> Lagerstedt	Stoermer & Kreis 1978
<i>Pinnularia ferroindulgentissima</i> Czarnecki & Cawley	Czarnecki & Cawley 1997
<i>Pinnularia flaminula</i> A. Schmidt	Patrick & Reimer 1966
<i>Pinnularia flexuosa</i> Cleve	Boyer 1927b
<i>Pinnularia flexuosa</i> var. <i>cuneata</i> (Tempère & Peragallo) Mills	Patrick & Reimer 1966
<i>Pinnularia flexuosa</i> var. <i>gibbosa</i> Hustedt	Hustedt 1934
<i>Pinnularia fluminea</i> Patrick & Freese	Lowe 1972–1973
<i>Pinnularia formica</i> (Ehrenberg) Patrick	Camburn 1982
<i>Pinnularia fossilis</i> Krammer	Krammer 2000
<i>Pinnularia gastrum</i>	Ehrenberg 1856
<i>Pinnularia gentilis</i> (Donkin) Cleve	Stoermer & Kreis 1978
<i>Pinnularia gibba</i> Ehrenberg	Stoermer & Kreis 1978
<i>Pinnularia gibba</i> f. <i>constricta</i> Skvortzow	Patrick & Reimer 1966
<i>Pinnularia gibba</i> f. <i>curta</i> Rabenhorst	Hohn & Hellerman 1963
<i>Pinnularia gibba</i> var. <i>gibba</i> Hustedt	Hustedt 1934
<i>Pinnularia gibba</i> var. <i>linearis</i> Hustedt	Stoermer & Kreis 1978
<i>Pinnularia gibba</i> var. <i>mesogongyla</i> (Ehrenberg) Hustedt	Reimer 1961
<i>Pinnularia gibba</i> var. <i>parva</i> (Ehrenberg) Grunow	Stoermer & Kreis 1978

Name	Publication
<i>Pinnularia gibba</i> var. <i>rostrata</i> Patrick	Patrick 1945
<i>Pinnularia gibba</i> f. <i>subundulata</i> A. Mayer	Stoermer & Kreis 1978
<i>Pinnularia gibbiformis</i> Krammer	Krammer 2000
<i>Pinnularia gibbiformis</i> var. <i>floralensis</i> Dute & Sullivan	Dute et al. 2000
<i>Pinnularia gigas</i> Ehrenberg	Krammer 2000
<i>Pinnularia globiceps</i> Gregory	Stoermer & Kreis 1978
<i>Pinnularia globiceps</i> var. <i>krockii</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Pinnularia gracillima</i> Gregory	Patrick & Reimer 1966
<i>Pinnularia gracilis</i> Hustedt	Lowe 1972–1973
<i>Pinnularia hannii</i> Patrick	Patrick 1946
<i>Pinnularia hemiptera</i> Rabenhorst	Stoermer & Kreis 1978
<i>Pinnularia hemiptera</i> var. <i>bielawski</i> Héribaud & Peragallo	Clark & Rushforth 1977
<i>Pinnularia hilseana</i> Janisch	Camburn 1982
<i>Pinnularia inaequalis</i>	Ehrenberg 1856
<i>Pinnularia instita</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Pinnularia integra</i> Grunow in Cleve	Cleve 1895
<i>Pinnularia intermedia</i> (Lagerstedt) Cleve	Stoermer & Kreis 1978
<i>Pinnularia interrupta</i> W. Smith	Stoermer & Kreis 1978
<i>Pinnularia interrupta</i> f. <i>bicapitata</i> (Lagerstedt) Fritsch	Patrick & Reimer 1966
<i>Pinnularia interrupta</i> var. <i>crassior</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Pinnularia interrupta</i> var. <i>sinica</i> Skvortzow	Patrick & Reimer 1966
<i>Pinnularia iridis</i>	Ehrenberg 1856
<i>Pinnularia isostauron</i> (Ehrenberg) Cleve	Patrick & Reimer 1966
<i>Pinnularia isselana</i> Krammer	Siver et al. 2005
<i>Pinnularia kasswingensis</i>	Ehrenberg 1856
<i>Pinnularia karelica</i> Cleve	Drum 1981
<i>Pinnularia kheuckeri</i> Hustedt	Collins & Kalinsky 1977
<i>Pinnularia kriegeriana</i> Krasske emend Foged	Stoermer et al. 1999
<i>Pinnularia krockii</i> (Grunow) Cleve	Stoermer et al. 1999
<i>Pinnularia kwacksii</i> Camburn & Charles	Camburn & Charles 2000
<i>Pinnularia lata</i> (Brébisson) W. Smith	Boyer 1927b
<i>Pinnularia lata</i> var. <i>amplissima</i> Manguin	Camburn 1982
<i>Pinnularia lata</i> var. <i>pachyptera</i> (Ehrenberg) Meister	Patrick & Reimer 1966
<i>Pinnularia lata</i> var. <i>rabenhorstii</i> (Grunow) Cleve	Boyer 1927b
<i>Pinnularia latevittata</i> Cleve	Patrick & Reimer 1966
<i>Pinnularia latevittata</i> var. <i>domingensis</i> Cleve	Stoermer & Kreis 1978
<i>Pinnularia latifascia</i> Patrick	Patrick 1946
<i>Pinnularia legumen</i> (Ehrenberg) Ehrenberg	Stoermer & Kreis 1978
<i>Pinnularia leptogongyla</i> Ehrenberg	Patrick & Reimer 1966
<i>Pinnularia leptosoma</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Pinnularia leptosoma</i> f. <i>erlangensis</i> A. Mayer	Stoermer & Kreis 1978
<i>Pinnularia leptostigma</i>	Ehrenberg 1856
<i>Pinnularia longa</i> Gregory	Patrick & Reimer 1966
<i>Pinnularia lundii</i> Hustedt	Hohn & Hellerman 1963
<i>Pinnularia macilentata</i> Ehrenberg	Patrick 1946
<i>Pinnularia major</i> (Kützing) Rabenhorst	Stoermer & Kreis 1978
<i>Pinnularia major</i> var. <i>asymmetrica</i> Cleve	Boyer 1927b
<i>Pinnularia major</i> var. <i>capitata</i> Hustedt	Hustedt 1934
<i>Pinnularia major</i> var. <i>heroína</i> (A. Schmidt) Cleve	Patrick & Reimer 1966
<i>Pinnularia major</i> var. <i>hustedti</i> Meister	Hansmann 1973
<i>Pinnularia major</i> var. <i>linearis</i> Cleve	Patrick & Reimer 1966
<i>Pinnularia major</i> var. <i>pulchella</i> Boyer	Boyer 1927b
<i>Pinnularia major</i> var. <i>subacuta</i> (Ehrenberg) Cleve	Patrick & Reimer 1966
<i>Pinnularia maior</i> var. <i>transversa</i> (A. Schmidt) Cleve	Camburn 1982
<i>Pinnularia major</i> var. <i>turgidula</i> Cleve	Patrick & Reimer 1966
<i>Pinnularia makahana</i> Sovereign	Patrick & Reimer 1966
<i>Pinnularia martyi</i> Lauby	Prescott & Dillard 1979

Name	Publication
<i>Pinnularia megaloptera</i>	Ehrenberg 1856
<i>Pinnularia mesogonglya</i> Ehrenberg	Camburn 1982
<i>Pinnularia mesolepta</i> (Ehrenberg) W. Smith	Stoermer & Kreis 1978
<i>Pinnularia mesolepta</i> var. <i>angusta</i> Cleve	Patrick & Reimer 1966
<i>Pinnularia mesolepta</i> var. <i>stauroneiformis</i> (Grunow) Cleve	Patrick & Reimer 1966
<i>Pinnularia mesolepta</i> var. <i>turbulenta</i> Cleve-Euler	Clark & Rushforth 1977
<i>Pinnularia mesotyla</i> Ehrenberg	Patrick & Reimer 1966
<i>Pinnularia microstauron</i> (Ehrenberg) Cleve	Stoermer & Kreis 1978
<i>Pinnularia microstauron</i> var. <i>adironackensis</i> Camburn & Charles	Camburn & Charles 2000
<i>Pinnularia microstauron</i> var. <i>biundulata</i> O. Müller	Stoermer & Kreis 1978
<i>Pinnularia microstauron</i> var. <i>lunicus</i> Camburn & Charles	Camburn & Charles 2000
<i>Pinnularia microstauron</i> var. <i>nonfasciata</i> Krammer	Krammer 2000
<i>Pinnularia molaris</i> (Grunow) Cleve	Boyer 1927b
<i>Pinnularia molaris</i> var. <i>asiatica</i> Skvortzow	Camburn et al. 1978
<i>Pinnularia montgomeryana</i> Krammer	Krammer 2000
<i>Pinnularia moralis</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Pinnularia mormonorum</i> (Grunow) Boyer	Boyer 1927b
<i>Pinnularia neglecta</i> (A. Mayer) A. Berg	Reimer 1990
<i>Pinnularia neomajor</i> Krammer	Siver et al. 2005
<i>Pinnularia nobilis</i> (Ehrenberg) W. Smith	Stoermer & Kreis 1978
<i>Pinnularia nodosa</i> (Ehrenberg) W. Smith	Stoermer & Kreis 1978
<i>Pinnularia nodosa</i> var. <i>constricta</i> f. <i>truncata</i> Fusey	Camburn & Charles 2000
<i>Pinnularia nodosa</i> var. <i>pseudogracillima</i> (May) A. Cleve	Clark & Rushforth 1977
<i>Pinnularia nodosa</i> var. <i>robusta</i> (Foged) Krammer	Siver et al. 2005
<i>Pinnularia notabilis</i> Krammer	Gaiser & Johansen 2000
<i>Pinnularia nubila</i> Sovereign	Patrick & Reimer 1966
<i>Pinnularia obscura</i> Krasske	Stoermer & Kreis 1978
<i>Pinnularia obtusa</i> Ehrenberg	Ehrenberg 1856
<i>Pinnularia obtusa</i> Sovereign	Patrick & Reimer 1966
<i>Pinnularia ohioensis</i> Ehrenberg	Ehrenberg 1856
<i>Pinnularia oregonica</i>	Ehrenberg 1856
<i>Pinnularia oxylepta</i> Ehrenberg	Ehrenberg 1856
<i>Pinnularia oxytrachea</i> Ehrenberg	Ehrenberg 1856
<i>Pinnularia palousiana</i> Sovereign	Patrick & Reimer 1966
<i>Pinnularia parallela</i> Brun	Boyer 1927b
<i>Pinnularia parva</i> Gregory	Boyer 1927b
<i>Pinnularia parvula</i> (Ralfs) Cleve-Euler	Patrick & Reimer 1966
<i>Pinnularia paulensis</i> Grunow in Cleve	Boyer 1927b
<i>Pinnularia peregrina</i>	Ehrenberg 1856
<i>Pinnularia permagna</i> J.W. Bailey	Ehrenberg 1856
<i>Pinnularia placentula</i>	Ehrenberg 1856
<i>Pinnularia platycephala</i> f. <i>ornata</i> Sovereign	Patrick & Reimer 1966
<i>Pinnularia platysoma</i>	Ehrenberg 1856
<i>Pinnularia pluviana</i> Sovereign	Krammer 2000
<i>Pinnularia podzorski</i> Krammer	Krammer 2000
<i>Pinnularia pogonii</i> Scherer	Scherer 1988
<i>Pinnularia polyonca</i> (Brébisson) W. Smith	Boyer 1927b
<i>Pinnularia pulchella</i> (Boyer) Krammer	Krammer 2000
<i>Pinnularia pulchra</i> Østrup	Clark & Rushforth 1977
<i>Pinnularia radiosa</i> W. Smith	Stoermer & Kreis 1978
<i>Pinnularia rivularis</i> Hustedt	Patrick & Reimer 1966
<i>Pinnularia rupestris</i> Hantzsch	Stoermer & Kreis 1978
<i>Pinnularia ruttneri</i> Hustedt	Stoermer & Kreis 1978
<i>Pinnularia sabae</i> Ehrenberg	Patrick & Reimer 1966
<i>Pinnularia schweinfurthii</i> (A. Schmidt) Patrick	Patrick & Reimer 1966
<i>Pinnularia secernenda</i> (A. Schmidt) Cleve	Boyer 1927b
<i>Pinnularia semen</i>	Ehrenberg 1856

Name	Publication
<i>Pinnularia semicrucata</i> A. Cleve	Stoermer & Kreis 1978
<i>Pinnularia signata</i>	Ehrenberg 1856
<i>Pinnularia silicula</i>	Ehrenberg 1856
<i>Pinnularia sillimanorum</i> Ehrenberg	Boyer 1927b
<i>Pinnularia singularis</i> (A. Schmidt) Cleve	Patrick & Reimer 1966
<i>Pinnularia sirokiana</i>	Ehrenberg 1856
<i>Pinnularia socialis</i> (T.C. Palmer) Hustedt	Stoermer & Kreis 1978
<i>Pinnularia stauroneis</i> Ehrenberg	Rushforth & Merkle 1988
<i>Pinnularia stauroptera</i> (Grunow) Cleve	Boyer 1927b
<i>Pinnularia stauroptera</i> var. <i>interrupta</i> Cleve	Patrick & Reimer 1966
<i>Pinnularia stauroptera</i> var. <i>semicrucata</i> Cleve	Patrick & Reimer 1966
<i>Pinnularia stomatophora</i> Grunow	Boyer 1927b
<i>Pinnularia stromatophora</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Pinnularia streptoraphe</i> Cleve	Boyer 1927b
<i>Pinnularia streptoraphe</i> var. <i>musciicola</i> Skvortzow	Reimer 1990
<i>Pinnularia striata</i>	Ehrenberg 1856
<i>Pinnularia stricta</i> Hustedt	Hohn & Hellerman 1963
<i>Pinnularia subanglica</i> Krammer	Siver et al. 2005
<i>Pinnularia subcapitata</i> Gregory	Stoermer & Kreis 1978
<i>Pinnularia subcapitata</i> var. <i>hilseana</i> (Janisch) O. Müller	Collins & Kalinsky 1977
<i>Pinnularia subcapitata</i> var. <i>hybrida</i> (Grunow) Frenguelli	Hohn & Hellerman 1963
<i>Pinnularia subcapitata</i> var. <i>lapponica</i> A. Cleve	Clark & Rushforth 1977
<i>Pinnularia subcapitata</i> var. <i>paucistriata</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Pinnularia subcapitata</i> var. <i>stauroneiformis</i> Van Heurck	Patrick 1945
<i>Pinnularia subgibba</i> var. <i>gracilis</i> Gaiser & Johansen	Gaiser & Johansen 2000
<i>Pinnularia subgibba</i> var. <i>hustedtii</i> Krammer	Gaiser & Johansen 2000
<i>Pinnularia subgibba</i> var. <i>lanceolata</i> Gaiser & Johansen	Gaiser & Johansen 2000
<i>Pinnularia subgibba</i> var. <i>sublinearis</i> Krammer	Krammer 2000
<i>Pinnularia sublinearis</i> (Grunow) Cleve	Patrick 1945
<i>Pinnularia subnodosa</i> Hustedt	Hustedt 1934
<i>Pinnularia subpalousiana</i> Sovereign	Patrick & Reimer 1966
<i>Pinnularia subrostrata</i> A. Cleve	Stoermer & Kreis 1978
<i>Pinnularia subsolaris</i> (Grunow) Cleve	Sovereign 1958
<i>Pinnularia substomatophora</i> Hustedt	Stoermer & Kreis 1978
<i>Pinnularia sudetica</i> Hilse	Stoermer & Kreis 1978
<i>Pinnularia sudetica</i> var. <i>britannica</i> (Grunow) Krammer	Krammer 2000
<i>Pinnularia sudetica</i> var. <i>commutata</i> (Grunow) Cleve-Euler	Johansen et al. 1983
<i>Pinnularia suecia</i>	Ehrenberg 1856
<i>Pinnularia superba</i> Cleve-Euler	Clark & Rushforth 1977
<i>Pinnularia tabellaria</i> Ehrenberg	Stoermer & Kreis 1978
<i>Pinnularia tabellaria</i> var. <i>stauroneiformis</i> Van Heurck	Boyer 1927b
<i>Pinnularia tenuis</i> Gregory	Stoermer & Kreis 1978
<i>Pinnularia tenuis</i> var. <i>interrupta</i> (Font.) A. Cleve	Stoermer & Kreis 1978
<i>Pinnularia termes</i> (Ehrenberg) A. Schmidt	Boyer 1927b
<i>Pinnularia termitina</i> (Ehrenberg) Patrick	Stoermer & Kreis 1978
<i>Pinnularia tibetana</i> Hustedt	Stoermer & Kreis 1978
<i>Pinnularia titusiana</i> Hagelstein	Lowe 1972–1973
<i>Pinnularia torta</i> (A. Mann) Patrick	Stoermer & Kreis 1978
<i>Pinnularia transversa</i> (W. Smith) A. Mayer	Gaiser & Johansen 2000
<i>Pinnularia trigonocephala</i> Cleve	Stoermer & Kreis 1978
<i>Pinnularia turfosphila</i> Gaiser & Johansen	Gaiser & Johansen 2000
<i>Pinnularia turnerae</i> Camburn & Charles	Camburn & Charles 2000
<i>Pinnularia umbrosa</i> Sovereign	Patrick & Reimer 1966
<i>Pinnularia undula</i> (Schumann) Krammer	Krammer 2000
<i>Pinnularia undula</i> var. <i>major</i> (A. Schmidt) Krammer	Krammer 2000
<i>Pinnularia undula</i> var. <i>mesoleptiformis</i> Krammer	Krammer 2000
<i>Pinnularia undulata</i> Gregory	Stoermer & Kreis 1978

Name	Publication
<i>Pinnularia undulata</i> var. <i>subundulata</i> Grunow	Stoermer & Kreis 1978
<i>Pinnularia ventricosa</i> Hustedt	Hustedt 1934
<i>Pinnularia vespa</i> Ehrenberg	Patrick & Reimer 1966
<i>Pinnularia viridiformes</i> Krammer	Gaiser & Johansen 2000
<i>Pinnularia viridis</i> (Nitzsch) Ehrenberg	Stoermer & Kreis 1978
<i>Pinnularia viridis</i> var. <i>commutata</i> (Grunow) Cleve	Stoermer & Kreis 1978
<i>Pinnularia viridis</i> var. <i>caudata</i> Boyer	Boyer 1927b
<i>Pinnularia viridis</i> var. <i>commutata</i> (Grunow) Cleve	Boyer 1927b
<i>Pinnularia viridis</i> var. <i>elliptica</i> Meister	Patrick 1945
<i>Pinnularia viridis</i> var. <i>fallax</i> Cleve	Boyer 1927b
<i>Pinnularia viridis</i> var. <i>minor</i> Cleve	Collins & Kalinsky 1977
<i>Pinnularia viridis</i> var. <i>rupestris</i> (Hantzsch) Cleve	Hohn 1951
<i>Pinnularia viridis</i> var. <i>sudetica</i> (Hilse) Hustedt	Patrick 1945
<i>Pinnularia viridula</i>	Ehrenberg 1856
<i>Pinnularia wisconsinensis</i> Camburn & Charles	Camburn & Charles 2000
<i>Pinnularia woerthensis</i> (A. Mayer) Krammer	Gaiser & Johansen 2000
<i>Placoneis abiskoensis</i> (Hustedt) Lange-Bertalot & Metzeltin	Johansen et al. 2004
<i>Placoneis anglica</i> (Ralfs in Pritchard) Lowe in Johansen et al.	Johansen et al. 2004
<i>Placoneis clementoides</i> (Hustedt) E.J. Cox	Stoermer et al. 1999
<i>Placoneis clementis</i> (Grunow) E.J. Cox	Stoermer et al. 1999
<i>Placoneis dicephala</i> (W. Smith) Mereschkowsky	Stoermer et al. 1999
<i>Placoneis elginensis</i> (Gregory)	Stoermer et al. 1999
<i>Placoneis exigua</i> (Gregory) Mereschkowsky	Stoermer et al. 1999
<i>Placoneis gastrum</i> (Ehrenberg) Mereschkowsky	Stoermer et al. 1999
<i>Placoneis lata</i> (M. Peragallo) Lowe in Johansen et al.	Johansen et al. 2004
<i>Placoneis neglecta</i> (Krasske) Lowe in Johansen et al.	Johansen et al. 2004
<i>Placoneis placentula</i> (Ehrenberg) Heinzerling	Stoermer et al. 1999
<i>Placoneis placentula</i> f. <i>rostrata</i> (Mayer) Bukhtiyarova	Stoermer et al. 1999
<i>Placoneis placentula</i> var. <i>rostrata</i> (A. Mayer) Andresen et al.	Andresen et al. 2000
<i>Plagiotropis arizonica</i> Czarnecki & Blinn	Czarnecki et al. 1981
<i>Plagiotropis lepidoptera</i> (Gregory) Reimer	Stoermer et al. 1999
<i>Plagiotropis lepidoptera</i> var. <i>proboscidea</i> (Cleve) Reimer	Camburn 1982
<i>Plagiotropis vitrea</i> (W. Smith) Grunow	Rushforth & Squires 1985
<i>Plagiotropis vitrea</i> var. <i>scaligera</i> (Grunow ex Cleve & Grunow) Peragallo	Rushforth & Squires 1985
<i>Planothidium apiculatum</i> (Patrick) Lowe in Johansen et al.	Johansen et al. 2004
<i>Planothidium calcar</i> (Cleve) Bukhtiyarova & Round	Stoermer et al. 1999
<i>Planothidium delicatulum</i> (Kützing) Round & Bukhtiyarova	Stoermer et al. 1999
<i>Planothidium dubium</i> (Grunow) Round & Bukhtiyarova	Stoermer et al. 1999
<i>Planothidium ellipticum</i> (A. Cleve) Round & Bukhtiyarova	Stoermer et al. 1999
<i>Planothidium fossile</i> (Tempère & Peragallo) Lowe in Johansen et al.	Johansen et al. 2004
<i>Planothidium frequentissimum</i> (Lange-Bertalot) Round & Bukhtiyarova	Siver et al. 2005
<i>Planothidium hauckianum</i> (Grunow) Round & Bukhtiyarova	Stoermer et al. 1999
<i>Planothidium hauckianum</i> var. <i>rostratum</i> (Schulz) Andresen et al.	Andresen et al. 2000
<i>Planothidium lanceolatum</i> (Brébisson) Round & Bukhtiyarova	Stoermer et al. 1999
<i>Planothidium lanceolatum</i> var. <i>bimaculatum</i> (Hustedt) Andresen et al.	Andresen et al. 2000
<i>Planothidium lanceolatum</i> var. <i>genuinum</i> (A. Mayer) Andresen et al.	Andresen et al. 2000
<i>Planothidium lanceolatum</i> var. <i>omissum</i> (Reimer) Andresen et al.	Andresen et al. 2000
<i>Planothidium oestrupii</i> (H. Bachmann & A. Cleve) Round & Bukhtiyarova	Stoermer et al. 1999
<i>Planothidium peragallii</i> (Brun & Héribaud) Round & Bukhtiyarova	Stoermer et al. 1999
<i>Planothidium peragalli</i> var. <i>fossilum</i> (Tempère & Peragallo) Andresen et al.	Andresen et al. 2000
<i>Planothidium peragalli</i> var. <i>parvulum</i> (Patrick) Andresen et al.	Andresen et al. 2000
<i>Playaensis circumfimbriata</i> Spaulding & Kociolek	Spaulding et al. 2002
<i>Playaensis furtiva</i> Spaulding & Kociolek	Spaulding et al. 2002

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<i>Pleurosira laevis</i> (Ehrenberg) Compère	Stoermer et al. 1999
<i>Pleurosigma acuminatum</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Pleurosigma angulatum</i> (Quekett) W. Smith	Dodd 1987
<i>Pleurosigma attenuatum</i> W. Smith	Stoermer & Kreis 1978
<i>Pleurosigma australe</i> Grunow	Patrick & Reimer 1966
<i>Pleurosigma boyeri</i> Keeley	Keeley 1926
<i>Pleurosigma delicatulum</i> W. Smith	Stoermer & Kreis 1978
<i>Pleurosigma delicatulum</i> var. <i>americana</i> Cleve	Patrick & Reimer 1966
<i>Pleurosigma elongatum</i> W. Smith	Patrick & Reimer 1966
<i>Pleurosigma eximium</i> (Thwaites) Cleve & Grunow	Stoermer & Kreis 1978
<i>Pleurosigma fasciolata</i> W. Smith	Ehrenberg 1856
<i>Pleurosigma formosum</i>	Sterrenburg 1991
<i>Pleurosigma kuetzingii</i> Grunow	Stoermer & Kreis 1978
<i>Pleurosigma normani</i>	Patrick & Reimer 1966
<i>Pleurosigma obscurum</i> W. Smith	Stoermer & Kreis 1978
<i>Pleurosigma obtusatum</i> Sullivant & Wormley	Collins & Kalinsky 1977
<i>Pleurosigma paradoxum</i> Peragallo	Patrick & Reimer 1966
<i>Pleurosigma salinarum</i> Grunow	Potapova & Charles 2002
<i>Pleurosigma salinarum</i> var. <i>boyeri</i> (Keeley) Reimer	Patrick & Reimer 1966
<i>Pleurosigma scalprum</i> Grunow	Cleve & Möller 1879
<i>Pleurosigma sciotense</i> Sullivan	Stoermer & Kreis 1978
<i>Pleurosigma spencerii</i> Grunow	Stoermer & Kreis 1978
<i>Pleurosigma spenceri</i> (Quekett) W. Smith	Tilden 1894–1909 (#90)
<i>Pleurosigma strigosum</i> W. Smith	Patrick & Reimer 1966
<i>Pleurosigma wansbeckii</i> Donkin	Cleve & Möller 1879
<i>Pleurosigma wormleyi</i> Sullivan	Stoermer & Kreis 1978
<i>Pleurostauron acuta</i> Rabenhorst	Tempère & Peragallo 1909
<i>Pleurostauron acuta</i> var. <i>robusta</i>	Tempère & Peragallo 1909
<i>Pleurostauron javanica</i> Grunow	Tempère & Peragallo 1911
<i>Pleurostauron smithii</i> Grunow	Tempère & Peragallo 1911
<i>Psammothidium abundans</i> f. <i>rosenstockii</i> (Lange-Bertalot) Bukhtiyarova	Stoermer et al. 1999
<i>Psammothidium altaicum</i> (Poretzky) Bukhtiyarova & Round	Stoermer et al. 1999
<i>Psammothidium bioreti</i> (Germain) Bukhtiyarova & Round	Stoermer et al. 1999
<i>Psammothidium daonense</i> (Lange-Bertalot) Lange-Bertalot	Siver et al. 2005
<i>Psammothidium didymum</i> (Hustedt) Bukhtiyarova & Round	Stoermer et al. 1999
<i>Psammothidium helveticum</i> (Hustedt) Bukhtiyarova	Potapova & Charles 2002
<i>Psammothidium lauenburgianum</i> (Hustedt) Round & Bukhtiyarova	Potapova & Charles 2003
<i>Psammothidium levanderi</i> (Hustedt) Bukhtiyarova & Round	Stoermer et al. 1999
<i>Psammothidium marginulatum</i> (Grunow) Bukhtiyarova & Round	Stoermer et al. 1999
<i>Psammothidium sacculum</i> (Carter) Bukhtiyarova in Bukhtiyarova & Round	Siver et al. 2005
<i>Psammothidium subatomoides</i> (Hustedt) Bukhtiyarova & Round	Stoermer et al. 1999
<i>Psammothidium ventralis</i> (Krasske) Bukhtiyarova & Round	Stoermer et al. 1999
<i>Pseudoeunotia lunaris</i> Ehrenberg	Stoermer & Kreis 1978
<i>Pseudostaurosira brevistriata</i> (Grunow in Van Heurck) Williams & Round	Stoermer et al. 1999
<i>Pseudostaurosira brevistriata</i> var. <i>binodis</i> (Pantocsek) Andresen et al.	Andresen et al. 2000
<i>Pseudostaurosira brevistriata</i> var. <i>capitata</i> (Héribaud) Andresen et al.	Andresen et al. 2000
<i>Pseudostaurosira brevistriata</i> var. <i>inflata</i> (Pantocsek) Edlund	Stoermer et al. 1999
<i>Pseudostaurosira clavatum</i> Morales	Morales 2002
<i>Pseudostaurosira construens</i> var. <i>binodis</i>	Stoermer et al. 1999
<i>Pseudostaurosira neoelliptica</i> (Witkowski) Morales	Morales 2002
<i>Pseudostaurosira parasitica</i> (W. Smith) Morales	Morales 2003
<i>Pseudostaurosira parasitica</i> var. <i>subconstricta</i> (Grunow) Morales	Morales 2003

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<i>Pseudostaurosira pseudoconstruens</i> (Marciniak) Williams & Round	Morales 2001
<i>Pseudostaurosira trainorii</i> Morales	Morales 2001
<i>Pseudostaurosiropsis connecticutensis</i> Morales	Morales 2001
<i>Pseudostaurosiropsis geocollegarum</i> (Witkowski & Lange-Bertalot) Morales	Morales 2002
<i>Reimeria sinuata</i> (Gregory) Kociolek & Stoermer	Stoermer et al. 1999
<i>Reimeria sinuata</i> f. <i>antiqua</i> (Gregory) Kociolek & Stoermer	Stoermer et al. 1999
<i>Rhizosolenia eriensis</i> H.L. Smith	Stoermer & Kreis 1978
<i>Rhizosolenia eriensis</i> var. <i>morsa</i> West & West	Gaufin et al. 1976
<i>Rhizosolenia eriensis</i> var. <i>pusilla</i> Wolosz. In Schroeder	Stoermer et al. 1999
<i>Rhizosolenia eriensis</i> var. <i>zachariasi</i> (Brun) Playfair	Stoermer et al. 1999
<i>Rhizosolenia gracilis</i> H.L. Smith	Stoermer & Kreis 1978
<i>Rhizosolenia longiseta</i> Zacharias	Stoermer & Kreis 1978
<i>Rhizosolenia minima</i> Levan	Czamecki et al. 1981
<i>Rhizosolenia rothii</i> (Ehrenberg) Grunow	Prescott & Dillard 1979
<i>Rhizosolenia stagnalis</i> Zacharias	Prescott & Dillard 1979
<i>Rhoicosphenia curvata</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Rhoicosphenia curvata</i> var. <i>gracilis</i>	Tempère & Peragallo 1912
<i>Rhoicosphenia curvata</i> var. <i>major</i> Cleve	Sovereign 1958
<i>Rhoicosphenia curvata</i> var. <i>minor</i>	Patrick 1968
<i>Rhoicosphenia curvata</i> var. <i>subacuta</i> M. Schmidt	Stoermer & Kreis 1978
<i>Rhopalodia argus</i> W. Smith	Stoermer & Kreis 1978
<i>Rhopalodia brebissonii</i> Krammer	Gaiser & Johansen 2000
<i>Rhopalodia gibba</i> (Ehrenberg) O. Müller	Stoermer & Kreis 1978
<i>Rhopalodia gibba</i> var. <i>parallela</i> (Ehrenberg) O. Müller	Reimer 1961
<i>Rhopalodia gibba</i> var. <i>ventricosa</i> (Kützing) Peragallo & Peragallo	Stoermer & Kreis 1978
<i>Rhopalodia gibberula</i> (Ehrenberg) O. Müller	Stoermer & Kreis 1978
<i>Rhopalodia gibberula</i> var. <i>producta</i> (Grunow) O. Müller	Patrick & Reimer 1975
<i>Rhopalodia gibberula</i> var. <i>protracta</i> Grunow	Patrick & Reimer 1975
<i>Rhopalodia gibberula</i> var. <i>rupestris</i> (W. Smith) O. Müller	Patrick & Reimer 1975
<i>Rhopalodia gibberula</i> var. <i>vanheurckii</i> O. Müller	Camburn 1982
<i>Rhopalodia musculus</i> (Kützing) O. Müller	Camburn 1982
<i>Rhopalodia musculus</i> var. <i>constricta</i> (Brébisson) Peragallo & Peragallo	Rushforth & Merkley 1988
<i>Rhopalodia parallela</i> (Grunow) O. Müller	Stoermer & Kreis 1978
<i>Rhopalodia ventricosa</i> (Kützing) Østrup	Prescott & Dillard 1979
<i>Rossithidium linearis</i> (W. Smith) Round & Bukhtiyarova	Stoermer et al. 1999
<i>Rossithidium pusillum</i> (Grunow) Round & Bukhtiyarova	Stoermer et al. 1999
<i>Rouxia californica</i> var. <i>minuta</i> A. Cleve	Stoermer & Kreis 1978
<i>Sarcophagodes delicatula</i> Morales 2002	Morales 2002
<i>Sceptroneis fibula</i> (Brébisson) Schutt	Elmore 1922
<i>Sceptroneis pacifica</i> (Grunow) Elmore	Collins & Kalinsky 1977
<i>Schizonema viridulum</i> Brébisson	Stoermer & Kreis 1978
<i>Schizonema vulgare</i> Thwaites	Stoermer & Kreis 1978
<i>Scoliopleura campylogramma</i> (Ehrenberg) Rabenhorst	Stoermer et al. 1999
<i>Scoliopleura peisonis</i> Grunow	Patrick & Reimer 1966
<i>Scoliopleura tumida</i> (Brébisson) Rabenhorst	Elmore 1922

Name	Publication
<i>Sellaphora americana</i> (Ehrenberg) D.G. Mann	Stoermer et al. 1999
<i>Sellaphora bacillarioides</i> (Grunow) Andresen et al.	Andresen et al. 2000
<i>Sellaphora bacilliformis</i> (Grunow) Mereschkowsky	Stoermer et al. 1999
<i>Sellaphora bacillum</i> (Ehrenberg) D.G. Mann	Stoermer et al. 1999
<i>Sellaphora disjuncta</i> (Hustedt) D.G. Mann	Hamilton et al. 1992
<i>Sellaphora laevis</i> (Kützing) D.G. Mann	Stoermer et al. 1999
<i>Sellaphora mutata</i> (Krasske) Lange-Bertalot	Stoermer et al. 1999
<i>Sellaphora nyassensis</i> (O. Müller) D.G. Mann	Stoermer et al. 1999
<i>Sellaphora nyassensis</i> f. <i>minor</i> (O. Müller) Andresen et al.	Andresen et al. 2000
<i>Sellaphora parapupula</i> Lange-Bertalot	Stoermer et al. 1999
<i>Sellaphora pupula</i> (Kützing) Mereschkowsky	Stoermer et al. 1999
<i>Sellaphora pupula</i> var. <i>elliptica</i> (Hustedt) Poulin	Stoermer et al. 1999
<i>Sellaphora pupula</i> var. <i>mutata</i> (Krasske) Poulin	Stoermer et al. 1999
<i>Sellaphora pupula</i> f. <i>rostrata</i> (Hustedt) Bukhtiyarova	Stoermer et al. 1999
<i>Sellaphora pupula</i> var. <i>rectangularis</i> (Gregory) Mereschkowsky	Stoermer et al. 1999
<i>Sellaphora rectangularis</i> (Gregory) Lange-Bertalot & Metzeltin	Stoermer et al. 1999
<i>Sellaphora rostrata</i> (Hustedt) Johansen in Johansen et al.	Johansen et al. 2004
<i>Sellaphora seminulum</i> (Grunow) D.G. Mann	Stoermer et al. 1999
<i>Sellaphora wummensis</i> Johansen in Johansen et al.	Johansen et al. 2004
<i>Sellaphora vitabunda</i> (Hustedt) D.G. Mann	Stoermer et al. 1999
<i>Semiorbis hemicyclus</i> (Ehrenberg) Patrick	Patrick & Reimer 1966
<i>Simonsenia delongei</i> (Grunow) Lange-Bertalot	Potapova & Charles 2002
<i>Skeletonema costatum</i> (Greville) Cleve	Stoermer & Kreis 1978
<i>Skeletonema potamos</i> (Weber) Hasle	Stoermer & Kreis 1978
<i>Skeletonema subsalsum</i> (A. Cleve) Bethge	Stoermer & Kreis 1978
<i>Sphinctocystis elliptica</i> (Kützing) Kuntze	Stoermer & Kreis 1978
<i>Sphinctocystis librilis</i> (Ehrenberg) Hassal	Stoermer & Kreis 1978
<i>Stauriforma exiguiformis</i> (Lange-Bertalot) Flower	Morales 2001
<i>Stauriforma inermis</i> Flower, Jones & Round	Morales 2001
<i>Stauroneis acuta</i> W. Smith	Stoermer & Kreis 1978
<i>Stauroneis acuta</i> var. <i>major</i>	Tempère & Peragallo 1909
<i>Stauroneis acuta</i> var. <i>terryana</i> Tempère ex Cleve	Patrick & Reimer 1966
<i>Stauroneis acutiuscula</i> M. Peragallo & Héribaud	Stoermer & Kreis 1978
<i>Stauroneis agrestris</i> Peterson	Stoermer & Kreis 1978
<i>Stauroneis alabamiae</i> Heiden	Stoermer & Kreis 1978
<i>Stauroneis alabamiae</i> var. <i>angulata</i> Heiden	Hohn 1951
<i>Stauroneis alabamiae</i> var. <i>rostrata</i> Heiden	Heiden 1903
<i>Stauroneis americana</i> Heiden	Boyer 1927b
<i>Stauroneis amphilepta</i> Ehrenberg	Patrick & Reimer 1966
<i>Stauroneis amphioxys</i> Gregory	Stoermer & Kreis 1978
<i>Stauroneis amphioxys</i> var. <i>obtusa</i> Hendey	Kalinsky 1983
<i>Stauroneis anceps</i> Ehrenberg	Stoermer & Kreis 1978
<i>Stauroneis anceps</i> var. <i>americana</i> Reimer	Stoermer & Kreis 1978
<i>Stauroneis anceps</i> var. <i>amphicephala</i> (Kützing) Cleve	Patrick 1945
<i>Stauroneis anceps</i> var. <i>birostris</i> (Ehrenberg) Cleve	Patrick & Reimer 1966
<i>Stauroneis anceps</i> var. <i>capitata</i> M. Peragallo	Tempère & Peragallo 1908
<i>Stauroneis anceps</i> var. <i>elongata</i> Tempère & Peragallo	Tempère & Peragallo 1911
<i>Stauroneis anceps</i> var. <i>fossilis</i> Cleve	Tempère & Peragallo 1912
<i>Stauroneis anceps</i> var. <i>gracilis</i> (Ehrenberg) Brun	Patrick 1945
<i>Stauroneis anceps</i> var. <i>hyalina</i> Brun & M. Peragallo	Stoermer & Kreis 1978
<i>Stauroneis anceps</i> var. <i>linearis</i> (Ehrenberg) Van Heurck	Patrick 1945

Name	Publication
<i>Stauroneis anceps</i> var. <i>nobilis</i>	Tempère & Peragallo 1909
<i>Stauroneis anceps</i> var. <i>prominula</i> Grunow	Hohn 1951
<i>Stauroneis anceps</i> var. <i>siberica</i> Grunow	Stoermer & Kreis 1978
<i>Stauroneis anceps</i> var. <i>subrostrata</i> Gaiser & Johansen	Gaiser & Johansen 2000
<i>Stauroneis anceps</i> f. <i>gracilis</i> Rabenhorst	Stoermer & Kreis 1978
<i>Stauroneis anceps</i> f. <i>linearis</i> (Ehrenberg) Hustedt	Stoermer & Kreis 1978
<i>Stauroneis arctica</i> A. Cleve	Bateman & Rushforth 1984
<i>Stauroneis baileyi</i> Ehrenberg	Boyer 1927b
<i>Stauroneis baconiana</i> Stodder	Boyer 1927b
<i>Stauroneis binodis</i> Ehrenberg	Patrick & Reimer 1966
<i>Stauroneis birostris</i> Ehrenberg	Patrick & Reimer 1966
<i>Stauroneis borrichii</i> (Petersen) Lund	Dodd 1987
<i>Stauroneis borrichii</i> f. <i>subcapitata</i> Peterson	Collins & Kalinsky 1977
<i>Stauroneis bovbjergii</i> Reimer	Reimer 1990
<i>Stauroneis brunii</i> M. Peragallo & Heriboad	Tempère & Peragallo 1913
<i>Stauroneis crucicula</i> (Grunow) Boyer	Boyer 1927b
<i>Stauroneis dicephala</i> Ehrenberg	Patrick & Reimer 1966
<i>Stauroneis dilatata</i> Ehrenberg	Stoermer & Kreis 1978
<i>Stauroneis dilatata</i> f. <i>baicalensis</i> Skvortzow & Meyer	Stoermer & Kreis 1978
<i>Stauroneis euglypta</i> Ehrenberg	Patrick & Reimer 1966
<i>Stauroneis eurysona</i> Ehrenberg	Patrick & Reimer 1966
<i>Stauroneis fenestra</i> Ehrenberg	Patrick & Reimer 1966
<i>Stauroneis fluminea</i> Patrick & Freese	Stoermer & Kreis 1978
<i>Stauroneis frickei</i> var. <i>angusta</i> Boyer	Boyer 1927b
<i>Stauroneis gallica</i> M. Peragallo	Patrick & Reimer 1966
<i>Stauroneis gracilior</i> (Rabenhorst) Reichardt	Siver et al. 2005
<i>Stauroneis gracilis</i> Ehrenberg	Stoermer & Kreis 1978
<i>Stauroneis gregorii</i> Ralfs	Stoermer & Kreis 1978
<i>Stauroneis ignorata</i> Hustedt	Collins & Kalinsky 1977
<i>Stauroneis ignorata</i> var. <i>rupestris</i> (Skvortzow) Reimer	Hansmann 1973
<i>Stauroneis javanica</i> Grunow	Cleve 1894
<i>Stauroneis kriegei</i> Patrick	Stoermer & Kreis 1978
<i>Stauroneis kriegei</i> f. <i>undulata</i> Hustedt	Stoermer & Kreis 1978
<i>Stauroneis lanceolata</i> Kützing	Tempère & Peragallo 1911
<i>Stauroneis lauenburgiana</i> Hustedt	Stoermer & Kreis 1978
<i>Stauroneis legleri</i> Hustedt	Kaczmarek & Rushforth 1983
<i>Stauroneis legumen</i> (Ehrenberg) Kützing	Boyer 1927b
<i>Stauroneis linearis</i> Ehrenberg	Stoermer & Kreis 1978
<i>Stauroneis lineolata</i> Ehrenberg	Patrick & Reimer 1966
<i>Stauroneis livingstonii</i> Reimer	Stoermer & Kreis 1978
<i>Stauroneis lundii</i> Hustedt	Clark & Rushforth 1977
<i>Stauroneis macrocephala</i> Kützing	Patrick & Reimer 1966
<i>Stauroneis maculata</i>	Ehrenberg 1856
<i>Stauroneis montana</i> Krasske	Collins & Kalinsky 1977
<i>Stauroneis muriella</i> f. <i>linearis</i> Lund	Rushforth & Squires 1985
<i>Stauroneis nana</i> Hustedt	Patrick & Reimer 1966
<i>Stauroneis neohyalina</i> Lange-Bertalot	Stoermer et al. 1999
<i>Stauroneis nobilis</i> Schumann	Patrick & Reimer 1966
<i>Stauroneis nobilis</i> var. <i>alabamiae</i> (Heiden) Cleve-Euler	Camburn 1982
<i>Stauroneis nobilis</i> var. <i>baconiana</i> (Stodder) Reimer	Stoermer & Kreis 1978
<i>Stauroneis nobilis</i> var. <i>gracilis</i> Kobayasi	Camburn & Charles 2000
<i>Stauroneis norvegica</i> Hustedt	Patrick & Reimer 1966
<i>Stauroneis obtusa</i> Lagerstedt	Stoermer & Kreis 1978
<i>Stauroneis obtusa</i> var. <i>catarinensis</i> Krasske	Dodd 1987
<i>Stauroneis palustris</i> Hustedt	Drum 1981
<i>Stauroneis parvula</i> (Grunow) Cleve	Boyer 1927b
<i>Stauroneis phoenicenteron</i> (Nitzsch) Ehrenberg	Stoermer & Kreis 1978

Name	Publication
<i>Stauroneis phoenicenteron</i> var. <i>amphilepta</i> (Ehrenberg) Cleve	Tiffany & Britton 1952
<i>Stauroneis phoenicenteron</i> var. <i>baileyi</i> Ehrenberg	Cleve 1894
<i>Stauroneis phoenicenteron</i> var. <i>brevis</i> Dippel	Stoermer & Kreis 1978
<i>Stauroneis phoenicenteron</i> var. <i>brunii</i> (Peragallo & Héribaud) Voigt	Collins & Kalinsky 1977
<i>Stauroneis phoenicenteron</i> var. <i>genuina</i> Cleve	Cleve 1894
<i>Stauroneis phoenicenteron</i> f. <i>gracilis</i> (Ehrenberg) Hustedt	Stoermer & Kreis 1978
<i>Stauroneis phoenicenteron</i> var. <i>intermedia</i> (Dippel) A. Cleve	Stoermer et al. 1999
<i>Stauroneis phoenicenteron</i> f. <i>lanceolata</i> (Kützing) Brun	Stoermer & Kreis 1978
<i>Stauroneis phoenicenteron</i> f. <i>linearis</i> (Ehrenberg) Hustedt	Reimer 1990
<i>Stauroneis phyllodes</i> Ehrenberg	Stoermer & Kreis 1978
<i>Stauroneis platalea</i> Ehrenberg	Patrick & Reimer 1966
<i>Stauroneis platysoma</i> Ehrenberg	Kalinsky 1983
<i>Stauroneis producta</i> Grunow	Stoermer & Kreis 1978
<i>Stauroneis pterodea</i> Ehrenberg	Tempère & Peragallo 1908
<i>Stauroneis pulchella</i> W. Smith	Tilden 1894–1909 (#367)
<i>Stauroneis pygmaea</i> Krieger	Dodd 1981
<i>Stauroneis quadrata</i> M. Peragallo & Héribaud	Tempère & Peragallo 1909
<i>Stauroneis schinzii</i> (Brun) Cleve	Boyer 1927b
<i>Stauroneis semen</i> Ehrenberg	Stoermer & Kreis 1978
<i>Stauroneis siberica</i> (Grunow) Lange-Bertalot	Stoermer et al. 1999
<i>Stauroneis sieboldii</i> Ehrenberg	Patrick & Reimer 1966
<i>Stauroneis smithii</i> Grunow	Stoermer & Kreis 1978
<i>Stauroneis smithii</i> var. <i>borgei</i> Ehrenberg	Stoermer et al. 1999
<i>Stauroneis smithii</i> var. <i>incisa</i> Pantocsek	Camburn 1982
<i>Stauroneis smithii</i> var. <i>minima</i> Haworth	Stoermer & Kreis 1978
<i>Stauroneis staurolineata</i> Reimer	Patrick & Reimer 1966
<i>Stauroneis stodderi</i> Greenleaf in Lewis	Stoermer & Kreis 1978
<i>Stauroneis subula</i>	Ehrenberg 1856
<i>Stauroneis tenera</i> Hustedt	Hohn & Hellenman 1963
<i>Stauroneis terryi</i> Ward in Palmer	Boyer 1927b
<i>Stauroneis thermicola</i> (Petersen) Lund	Dodd 1987
<i>Stauroneis triundulatum</i> Borge	Patrick & Reimer 1966
<i>Stauroneis virginica</i>	Ehrenberg 1856
<i>Stauroneis wislouchii</i> Poretzky & Anisimata	Grimes & Rushforth 1982
<i>Staurophora amphioxys</i> (Gregory) D.G. Mann	Stoermer et al. 1999
<i>Stauroptera aspera</i>	Ehrenberg 1856
<i>Stauroptera isostauron</i>	Ehrenberg 1856
<i>Stauroptera legumen</i>	Ehrenberg 1856
<i>Stauroptera microstauron</i>	Ehrenberg 1856
<i>Stauroptera parva</i>	Ehrenberg 1856
<i>Stauroptera trinodis</i>	Ehrenberg 1856
<i>Stausosira brevistriata</i> Grunow	Stoermer & Kreis 1978
<i>Stausosira capucina</i> Borzsc.	Stoermer & Kreis 1978
<i>Stausosira construens</i> Ehrenberg	Williams & Round 1987
<i>Stausosira construens</i> var. <i>binodis</i> (Ehrenberg) Hamilton in Hamilton et al.	Hamilton et al. 1992
<i>Stausosira construens</i> var. <i>capitata</i> (Héribaud) Andresen et al.	Andresen et al. 2000
<i>Stausosira construens</i> var. <i>minuta</i> (Tempère & Peragallo) Andresen et al.	Andresen et al. 2000
<i>Stausosira construens</i> f. <i>subsalina</i> (Hustedt) Andresen et al.	Andresen et al. 2000
<i>Stausosira construens</i> var. <i>venter</i> (Ehrenberg) Hamilton	Stoermer et al. 1999
<i>Stausosira elliptica</i> (Schumann) Williams & Round	Morales 2001
<i>Stausosira entomon</i> Ehrenberg	Stoermer & Kreis 1978
<i>Stausosira leptostauron</i> var. <i>dubia</i> (Grunow) Edlund	Stoermer et al. 1999
<i>Stausosira mutabilis</i> (W. Smith) Grunow	Stoermer & Kreis 1978
<i>Stausosira pinnata</i>	Ehrenberg 1856

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<i>Stausosira stevensonii</i> Manoylov, Morales & Stoermer	Manoylov et al. 2003
<i>Stausosira venter</i> (Ehrenberg) Grunow in Pantocsek	Siver et al. 2005
<i>Stausosirella berolinensis</i> (Lemmerman) Edlund	Morales 2002
<i>Stausosirella lapponica</i> (Grunow in Van Heurck) Williams & Round	Stoermer et al. 1999
<i>Stausosirella leptostauron</i> (Ehrenberg) Williams & Round	Stoermer et al. 1999
<i>Stausosirella leptostauron</i> var. <i>dubia</i> (Grunow) Bukhtiyarova	Morales 2002
<i>Stausosirella leptostauron</i> var. <i>fossilis</i> (Pantocsek) Andresen et al.	Andresen et al. 2000
<i>Stausosirella leptostauron</i> var. <i>rhomboides</i> (Grunow) Andresen et al.	Andresen et al. 2000
<i>Stausosirella pinnata</i> (Ehrenberg) Williams & Round	Williams & Round 1987
<i>Stausosirella pinnata</i> var. <i>intercedens</i> (Grunow in Van Heurck) Hamilton	Stoermer et al. 1999
<i>Stausosirella pinnata</i> var. <i>lancettula</i> (Schumann) Siver & Hamilton in Siver et al.	Siver et al. 2005
<i>Stausosirella trigona</i> (Brun & Héribaud) Siver & Hamilton in Siver et al.	Siver et al. 2005
<i>Stenopterobia anceps</i> (Lewis) Brébisson	Stoermer et al. 1999
<i>Stenopterobia anceps</i> f. <i>subacuta</i> Fricke	Hustedt 1912
<i>Stenopterobia curvula</i> (W. Smith) Krammer	Dute et al. 2000
<i>Stenopterobia delicatissima</i> (Lewis) Brébisson	Dute et al. 2000
<i>Stenopterobia densestriata</i> (Hustedt) Krammer	Gaiser & Johansen 2000
<i>Stenopterobia intermedia</i> (Lewis) Fricke	Stoermer & Kreis 1978
<i>Stenopterobia intermedia</i> f. <i>densistriata</i> Hustedt	Whitford & Schumacher 1973
<i>Stenopterobia intermedia</i> f. <i>subacuta</i> Fricke	Camburn 1982
<i>Stenopterobia intermedia</i> f. <i>undulata</i> Sovereign	Sovereign 1963
<i>Stenopterobia rautenbachiae</i>	Patrick & Roberts 1979
<i>Stephanodiscus alpinus</i> Hustedt	Stoermer & Kreis 1978
<i>Stephanodiscus astraea</i> (Ehrenberg) Grunow	Stoermer & Kreis 1978
<i>Stephanodiscus astraea</i> var. <i>intermedia</i> Fricke	Stoermer & Kreis 1978
<i>Stephanodiscus astraea</i> var. <i>minutula</i> Grunow	Stoermer & Kreis 1978
<i>Stephanodiscus astraea</i> var. <i>minutulus</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Stephanodiscus astraea</i> var. <i>spinulosa</i>	Tempère & Peragallo 1909
<i>Stephanodiscus barkleyi</i> Rattray	Whitford 1956
<i>Stephanodiscus binatus</i> Håkansson & Kling	Siver et al. 2005
<i>Stephanodiscus binderanus</i> (Kützing) Kreiger	Stoermer & Kreis 1978
<i>Stephanodiscus binderanus</i> var. <i>oestrupii</i> (A. Cleve) A. Cleve	Stoermer & Kreis 1978
<i>Stephanodiscus carconensis</i> Grunow	Stoermer & Kreis 1978
<i>Stephanodiscus carconensis</i> var. <i>minor</i>	Tempère & Peragallo 1912
<i>Stephanodiscus carconensis</i> var. <i>pusilla</i> Grunow	Stoermer & Kreis 1978
<i>Stephanodiscus conspicueporus</i> Stoermer, Håkansson & Theriot	Stoermer et al. 1999
<i>Stephanodiscus dubius</i> (Fricke) Hustedt	Stoermer & Kreis 1978
<i>Stephanodiscus excentricus</i> Hustedt	Kociolek & Herbst 1992
<i>Stephanodiscus hantzschii</i> Grunow	Stoermer & Kreis 1978
<i>Stephanodiscus hantzschii</i> var. <i>delicatula</i> Cleve	Whitford & Schumacher 1973
<i>Stephanodiscus hantzschii</i> f. <i>tenuis</i> (Hustedt) Håkansson & Stoermer	Stoermer et al. 1999
<i>Stephanodiscus hantzschii</i> var. <i>pusilla</i> Grunow	Stoermer & Kreis 1978
<i>Stephanodiscus invisitatus</i> Hohn & Helleman	Stoermer & Kreis 1978
<i>Stephanodiscus kuetzingiana</i> (nomen nudum)	Stoermer & Kreis 1978
<i>Stephanodiscus lucens</i> Hustedt	Stoermer et al. 1999
<i>Stephanodiscus medius</i> Håkansson	Stoermer et al. 1999
<i>Stephanodiscus minutula</i> (Kützing) Round	Stoermer et al. 1999
<i>Stephanodiscus minutulus</i> (Kützing) Cleve & Möller	Stoermer et al. 1999
<i>Stephanodiscus minutus</i> Grunow	Stoermer & Kreis 1978
<i>Stephanodiscus niagarae</i> Ehrenberg	Stoermer & Kreis 1978
<i>Stephanodiscus niagarae</i> var. <i>magnifica</i> Fricke	Stoermer & Kreis 1978
<i>Stephanodiscus parvus</i> Stoermer & Håkansson	Stoermer et al. 1999
<i>Stephanodiscus reimerii</i> Theriot & Stoermer	Theriot 1992
<i>Stephanodiscus rotula</i> (Kützing) Hendey	Stoermer & Kreis 1978

Name	Publication
<i>Stephanodiscus rotula</i> var. <i>minutula</i> (Kützing) Grunow	Stoermer & Kreis 1978
<i>Stephanodiscus subsalsus</i> (A. Cleve) Hustedt	Stoermer & Kreis 1978
<i>Stephanodiscus subtilis</i> (Van Goor) A. Cleve	Stoermer & Kreis 1978
<i>Stephanodiscus subtransilvanicus</i> Gasse	Stoermer et al. 1999
<i>Stephanodiscus superiorensis</i> Stoermer & Theriot	Stoermer et al. 1999
<i>Stephanodiscus tenuis</i> Hustedt	Stoermer & Kreis 1978
<i>Stephanodiscus transylvanicus</i> Pantocsek	Stoermer & Kreis 1978
<i>Stephanodiscus vestibulis</i> Håkansson, Stoermer & Theriot	Stoermer et al. 1999
<i>Stephanodiscus yellowstonensis</i> Theriot & Stoermer	Theriot & Stoermer 1984
<i>Stephanosira mississippiica</i>	Ehrenberg 1856
<i>Striatella fenestrata</i> (Lyngbye) Kuntze	Stoermer & Kreis 1978
<i>Striatella flocculosa</i> (Roth) Kuntze	Stoermer & Kreis 1978
<i>Surirella acredula</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Surirella adumbratus</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Surirella agmatilis</i> Camburn	Camburn 1982
<i>Surirella alicula</i> Hohn & Hellerman	Collins & Kalinsky 1977
<i>Surirella amphioxys</i> W. Smith	Stoermer & Kreis 1978
<i>Surirella anceps</i> Lewis	Stoermer & Kreis 1978
<i>Surirella angusta</i> Kützing	Stoermer & Kreis 1978
<i>Surirella apiculata</i> W. Smith	Stoermer & Kreis 1978
<i>Surirella arcta</i> A. Schmidt	Tempère & Peragallo 1909
<i>Surirella arctissima</i> A. Schmidt	Boyer 1927b
<i>Surirella baileyi</i> Lewis	Boyer 1927b
<i>Surirella barca</i> Hohn & Hellerman	Hohn & Hellerman 1963
<i>Surirella beadensis</i> Sovereign	Sovereign 1963
<i>Surirella bifrons</i> Ehrenberg	Stoermer & Kreis 1978
<i>Surirella birostrata</i> Hustedt	Stoermer & Kreis 1978
<i>Surirella biseriata</i> Brébisson & Godey	Stoermer & Kreis 1978
<i>Surirella biseriata</i> var. <i>bifrons</i> (Ehrenberg) Hustedt	Stoermer & Kreis 1978
<i>Surirella biseriata</i> var. <i>bifrons</i> f. <i>amphioxys</i> (W. Smith) Hustedt	Whitford & Schumacher 1973
<i>Surirella biseriata</i> var. <i>bifrons</i> f. <i>punctata</i> Meister	Stoermer et al. 1999
<i>Surirella biseriata</i> var. <i>constricta</i> Grunow	Whitford & Schumacher 1973
<i>Surirella biseriata</i> var. <i>diminuta</i> A. Cleve	Stoermer & Kreis 1978
<i>Surirella biseriata</i> var. <i>orientalis</i> Skvortzow	Stoermer et al. 1999
<i>Surirella biseriata</i> var. <i>subacuminata</i> Grunow	Clark & Rushforth 1977
<i>Surirella bohémica</i> Maly	Clark & Rushforth 1977
<i>Surirella brebissonii</i> Krammer & Lange-Bertalot	Stoermer et al. 1999
<i>Surirella brebissonii</i> var. <i>kuetzingii</i> Krammer & Lange-Bertalot	Potapova & Charles 2003
<i>Surirella brightwellii</i> W. Smith	Camburn 1982
<i>Surirella capronii</i> Kitton	Boyer 1927b
<i>Surirella cardinalis</i> Kitton	Stoermer & Kreis 1978
<i>Surirella carolinensis</i>	Ehrenberg 1856
<i>Surirella carolinicola</i> Camburn	Camburn 1982
<i>Surirella circumscuta</i>	Ehrenberg 1856
<i>Surirella cocconeis</i>	Ehrenberg 1856
<i>Surirella constricta</i>	Ehrenberg 1856
<i>Surirella craticula</i> Ehrenberg	Rushforth & Merkley 1988
<i>Surirella crenulata</i> Ehrenberg	H.L. Smith 1876–1888 (#517)
<i>Surirella cruciata</i> A. Schmidt	Tempère & Peragallo 1909
<i>Surirella crumena</i> Brébisson in Kützing	Boyer 1927b
<i>Surirella cuspidata</i> Hustedt	Camburn & Charles 2000
<i>Surirella delicatissima</i> Lewis	Stoermer & Kreis 1978
<i>Surirella delicatissima</i> f. <i>tenuissima</i> Manguin	Dixit & Smol 1995
<i>Surirella didyma</i> Kützing	Stoermer & Kreis 1978

Name	Publication
<i>Surirella elegans</i> Ehrenberg	Stoermer & Kreis 1978
<i>Surirella elegans</i> f. <i>minor</i>	Tempère & Peragallo 1908
<i>Surirella elegans</i> var. <i>norwegica</i> (Eulenstein) Brun	Clark & Rushforth 1977
<i>Surirella elliptica</i> Terry	Tempère & Peragallo 1908
<i>Surirella engleri</i>	Patrick & Roberts 1979
<i>Surirella eximia</i>	Ehrenberg 1856
<i>Surirella fasciculata</i> O. Müller.	Stoermer et al. 1971
<i>Surirella flexuosa</i>	Ehrenberg 1856
<i>Surirella geroltii</i> Ehrenberg	H.L. Smith 1876-1888 (#517)
<i>Surirella gracilis</i> (W. Smith) Grunow	Stoermer & Kreis 1978
<i>Surirella gracilis</i> var. <i>gigantea</i> Tempère & Peragallo	Tempère & Peragallo 1909
<i>Surirella guatemalensis</i> Ehrenberg	Stoermer & Kreis 1978
<i>Surirella helvetica</i> Brun	Hansmann 1973
<i>Surirella intermedia</i> Lewis	Boyer 1927b
<i>Surirella iowensis</i> Lowe	Collins & Kalinsky 1977
<i>Surirella kittonii</i> A. Schmidt	Tempère & Peragallo 1908
<i>Surirella kittonii</i> var. <i>asperula</i> M. Peragallo in Tempère & Peragallo	Tempère & Peragallo 1908
<i>Surirella lagerheimii</i> Cleve	Stoermer & Kreis 1978
<i>Surirella librile</i> Ehrenberg	Stoermer & Kreis 1978
<i>Surirella limosa</i> J.W. Bailey	H.L. Smith 1876-1888 (#523)
<i>Surirella linea</i>	Ehrenberg 1856
<i>Surirella linearis</i> W. Smith	Stoermer & Kreis 1978
<i>Surirella linearis</i> var. <i>constricta</i> (Ehrenberg) Grunow	Stoermer & Kreis 1978
<i>Surirella linearis</i> var. <i>helvetica</i> (Brun) Meister	Stoermer & Kreis 1978
<i>Surirella litoralis</i> Hustedt	Kalinsky 1983
<i>Surirella macra</i> A. Schmidt	Cleve & Möller 1879
<i>Surirella marylandica</i>	Ehrenberg 1856
<i>Surirella minuta</i> Brébisson	Stoermer & Kreis 1978
<i>Surirella molleriana</i> Grunow	Stoermer & Kreis 1978
<i>Surirella myodon</i> Ehrenberg	Ehrenberg 1856
<i>Surirella nervosa</i> A. Schmidt	Aubert 1895
<i>Surirella nevadensis</i> Hanna & Grant	Kociolek & Herbst 1992
<i>Surirella norvegica</i> Eulenstein	Stoermer & Kreis 1978
<i>Surirella oblonga</i> Ehrenberg	Boyer 1927b
<i>Surirella oophaena</i>	Ehrenberg 1856
<i>Surirella oregonica</i> Ehrenberg	Stoermer & Kreis 1978
<i>Surirella oregonica</i> f. <i>minor</i> Tempère & Peragallo	Tempère & Peragallo 1909
<i>Surirella ovalis</i> Brébisson	Stoermer & Kreis 1978
<i>Surirella ovalis</i> var. <i>angusta</i> (Kützing) Van Heurck	Tilden 1894-1909 (#248)
<i>Surirella ovalis</i> var. <i>baltica</i> (Schumann) Cleve	Benson & Rushforth 1975
<i>Surirella ovalis</i> var. <i>brightwellii</i> (W. Smith) A. Cleve	Grimes & Rushforth 1982
<i>Surirella ovalis</i> var. <i>minuta</i> Van Heurck	Stoermer & Kreis 1978
<i>Surirella ovata</i> Kützing	Stoermer & Kreis 1978
<i>Surirella ovata</i> var. <i>africana</i> Cholnoky	Camburn 1982
<i>Surirella ovata</i> var. <i>crumena</i> (W. Smith) Hustedt	Stoermer & Kreis 1978
<i>Surirella ovata</i> var. <i>pinnata</i> (W. Smith) Rabenhorst	Stoermer & Kreis 1978
<i>Surirella ovata</i> var. <i>salina</i> (W. Smith) Rabenhorst	Stoermer & Kreis 1978
<i>Surirella ovata</i> var. <i>subsalina</i>	Patrick 1968
<i>Surirella ovata</i> var. <i>utahensis</i> Grunow	Rushforth & Merkley 1988
<i>Surirella palmeri</i> Boyer	Boyer 1927b
<i>Surirella panduriformis</i> W. Smith	Stoermer & Kreis 1978
<i>Surirella parma</i> Sovereign	Sovereign 1963
<i>Surirella patella</i> Ehrenberg	Whitford & Schumacher 1973
<i>Surirella patella</i> var. <i>neupaueri</i> (Pantocsek) Cleve-Euler	Whitford & Schumacher 1973
<i>Surirella peisonis</i> Pantocsek	Stoermer et al. 1999
<i>Surirella pinnata</i> W. Smith	Boyer 1927b
<i>Surirella pinnata</i> var. <i>panduriformis</i> (W. Smith) Hustedt	Stoermer et al. 1999

Name	Publication
<i>Surirella plicata</i>	Ehrenberg 1856
<i>Surirella pseudovalis</i> Hustedt	Grimes & Rushforth 1982
<i>Surirella pygmaea</i>	Ehrenberg 1856
<i>Surirella rattrayi</i> A. Schmidt	Aubert 1895
<i>Surirella regina</i> Janisch in A. Schmidt	Boyer 1927b
<i>Surirella regula</i> Ehrenberg	Ehrenberg 1856
<i>Surirella robusta</i> Ehrenberg	Stoermer & Kreis 1978
<i>Surirella robusta</i> var. <i>armata</i> Hustedt	Stoermer et al. 1999
<i>Surirella robusta</i> var. <i>erosa</i>	Tempère & Peragallo 1908
<i>Surirella robusta</i> var. <i>splendida</i> (Ehrenberg) Van Heurck	Stoermer & Kreis 1978
<i>Surirella robusta</i> var. <i>splendida</i> f. <i>hustedtiana</i> (Mayer) Hustedt	Bateman & Rushforth 1984
<i>Surirella robusta</i> var. <i>splendida</i> f. <i>punctata</i> Hustedt	Camburn 1982
<i>Surirella robustior</i> MacKay	Stoermer & Kreis 1978
<i>Surirella rudis</i> Hustedt	Czarnecki et al. 1981
<i>Surirella saxonica</i> Auerswald	Stoermer & Kreis 1978
<i>Surirella sigmoidea</i> Ehrenberg	Stoermer & Kreis 1978
<i>Surirella spiralis</i> Kützing	Stoermer & Kreis 1978
<i>Surirella splendida</i> Ehrenberg	Stoermer & Kreis 1978
<i>Surirella splendida</i> var. <i>nervosa</i> A. Schmidt	Tempère & Peragallo 1908
<i>Surirella splendida</i> f. <i>punctata</i> Hustedt	Sovereign 1958
<i>Surirella stalagma</i> Hohn & Helleman	Camburn 1982
<i>Surirella stoermerii</i> Lowe	Lowe 1972–1973
<i>Surirella striata</i> Leud.-Fortm.	Stoermer & Kreis 1978
<i>Surirella striatula</i> Turpin	Stoermer & Kreis 1978
<i>Surirella subsalsa</i> W. Smith	Collins & Kalinsky 1977
<i>Surirella suecica</i> Grunow	Hohn & Helleman 1963
<i>Surirella suevica</i> Zeller	Stoermer & Kreis 1978
<i>Surirella tenera</i> Gregory	Stoermer & Kreis 1978
<i>Surirella tenera</i> var. <i>nervosa</i> A. Schmidt	Stoermer & Kreis 1978
<i>Surirella tenera</i> var. <i>palmeri</i> (Boyer) Hustedt	Patrick 1945
<i>Surirella tenera</i> var. <i>robusta</i>	Tempère & Peragallo 1908
<i>Surirella tenera</i> var. <i>splendidula</i> A. Schmidt	Tempère & Peragallo 1908
<i>Surirella tenuis</i> Mayer	Stoermer et al. 1999
<i>Surirella tenuissima</i> Hustedt	Stoermer & Kreis 1978
<i>Surirella terryi</i> Ward	Boyer 1927b
<i>Surirella testudinella</i>	Ehrenberg 1856
<i>Surirella testudo</i> Ehrenberg	Ehrenberg 1856
<i>Surirella triumphans</i> A. Schmidt	Boyer 1927b
<i>Surirella turgida</i> W. Smith	Stoermer & Kreis 1978
<i>Surirella undata</i> Ehrenberg	Ehrenberg 1856
<i>Surirella undulata</i> Ehrenberg	Stoermer & Kreis 1978
<i>Surirella utahensis</i> (Grunow) Hanna & Grant	Rushforth & Merkley 1988
<i>Surirella valida</i> Ehrenberg	Tempère & Peragallo 1908
<i>Surirella valida</i> var. <i>erosa</i>	Tempère & Peragallo 1908
<i>Surirella valida</i> var. <i>triumphanus</i>	Tempère & Peragallo 1908
<i>Surirella verrucosa</i> Pantocsek	Hayak & Hulbary 1956
<i>Surirella virginica</i>	Ehrenberg 1856
<i>Synedra actinastroides</i> Lemmermann	Stoermer & Kreis 1978
<i>Synedra acus</i> Kützing	Stoermer & Kreis 1978
<i>Synedra acus</i> var. <i>angustissima</i> Grunow	Stoermer & Kreis 1978
<i>Synedra acus</i> var. <i>delicatissima</i> (W. Smith) Van Heurck	Patrick 1945
<i>Synedra acus</i> var. <i>radians</i> (Kützing) Hustedt	Stoermer & Kreis 1978
<i>Synedra acuta</i> Ehrenberg	Patrick & Reimer 1966
<i>Synedra acutissimus</i>	Patrick & Reimer 1966
<i>Synedra aequalis</i> Kützing	Boyer 1927a
<i>Synedra affinis</i> Kützing	Stoermer & Kreis 1978

Name	Publication
<i>Synedra affinis</i> var. <i>acuminata</i> Grunow	Rushforth & Merkley 1988
<i>Synedra affinis</i> var. <i>fasciculata</i> (Kützing) Grunow	Patrick & Reimer 1966
<i>Synedra affinis</i> var. <i>gracilis</i> Grunow	Collins & Kalinsky 1977
<i>Synedra affinis</i> var. <i>lancettula</i> Grunow	Rushforth & Merkley 1988
<i>Synedra amphicephala</i> Kützing	Stoermer & Kreis 1978
<i>Synedra amphicephala</i> var. <i>asiatica</i> Skvortzow	Stoermer et al. 1999
<i>Synedra amphicephala</i> var. <i>austriaca</i> (Grunow) Hustedt	Stoermer & Kreis 1978
<i>Synedra amphicephala</i> var. <i>intermedia</i> A. Cleve	Stoermer et al. 1999
<i>Synedra amphioxys</i>	Ehrenberg 1856
<i>Synedra amphirhynchus</i> Rabenhorst	Boyer 1927a
<i>Synedra berolinensis</i> Lemmermann	Drum 1981
<i>Synedra biceps</i> Kützing	Camburn 1982
<i>Synedra bicurvata</i> Biene in Rabenhorst	Boyer 1927a
<i>Synedra capensis</i> Grunow	Collins & Kalinsky 1977
<i>Synedra capitata</i> Ehrenberg	Stoermer & Kreis 1978
<i>Synedra chaseii</i> Thomas	Stoermer & Kreis 1978
<i>Synedra crotonensis</i> Grunow	Stoermer & Kreis 1978
<i>Synedra crotonensis</i> Edwards	Cleve & Möller 1878
<i>Synedra crotonensis</i> var. <i>prolongata</i> Grunow	Stoermer & Kreis 1978
<i>Synedra cyclopus</i> Brutschy	Stoermer & Kreis 1978
<i>Synedra cyclopus</i> var. <i>gibbosa</i> Naegeli	Prescott & Dillard 1979
<i>Synedra cyclopus</i> var. <i>robustum</i> Schulz	Patrick & Reimer 1966
<i>Synedra danica</i> Kützing	Stoermer & Kreis 1978
<i>Synedra debilis</i>	H.L. Smith 1876-1888 (#690)
<i>Synedra delicatissima</i> W. Smith	Stoermer & Kreis 1978
<i>Synedra delicatissima</i> var. <i>angustissima</i> Grunow	Stoermer & Kreis 1978
<i>Synedra delicatissima</i> f. <i>longissima</i>	Cleve & Möller 128
<i>Synedra delicatissima</i> var. <i>mesoleia</i>	Tempère & Peragallo 1909
<i>Synedra demerarae</i> Grunow	Stoermer & Kreis 1978
<i>Synedra dicephala</i>	Patrick & Reimer 1966
<i>Synedra dorsiventralis</i> Müller	Patrick & Reimer 1966
<i>Synedra entomon</i>	Ehrenberg 1856
<i>Synedra famelica</i> Kützing	Stoermer & Kreis 1978
<i>Synedra fasciculata</i> (Agardh) Kützing	Stoermer & Kreis 1978
<i>Synedra fasciculata</i> var. <i>truncata</i> (Greville) Patrick	Stoermer & Kreis 1978
<i>Synedra filiformis</i> Grunow	Stoermer & Kreis 1978
<i>Synedra filiformis</i> var. <i>exilis</i> A. Cleve	Stoermer & Kreis 1978
<i>Synedra flexuosa</i>	Ehrenberg 1856
<i>Synedra gaillonii</i> (Bory) Ehrenberg	Stoermer & Kreis 1978
<i>Synedra goulardi</i> Brébisson	Stoermer & Kreis 1978
<i>Synedra goulardi</i> var. <i>fluviatilis</i> (Lemmermann) Frenguelli	Stoermer et al. 1999
<i>Synedra homostriata</i> Hohn	Patrick & Reimer 1966
<i>Synedra hyalina</i> Tempère & Peragallo	Patrick & Reimer 1966
<i>Synedra hyperborea</i> Grunow	Stoermer & Kreis 1978
<i>Synedra hyperborea</i> var. <i>rostellata</i> Grunow	Stoermer & Kreis 1978
<i>Synedra incisa</i> Boyer	Stoermer & Kreis 1978
<i>Synedra laevigata</i> Grunow	Stoermer & Kreis 1978
<i>Synedra lanceolata</i> Kützing	Stoermer & Kreis 1978
<i>Synedra longiceps</i> Ehrenberg	Stoermer & Kreis 1978
<i>Synedra longissima</i> W. Smith	Stoermer & Kreis 1978
<i>Synedra lunaris</i> Ehrenberg	Stoermer & Kreis 1978
<i>Synedra mazamaensis</i> Sovereign	Stoermer et al. 1999
<i>Synedra minuscula</i> Grunow	Stoermer & Kreis 1978
<i>Synedra montana</i> Krasske	Stoermer & Kreis 1978
<i>Synedra nana</i> Meister	Camburn 1982
<i>Synedra netronoides</i> Hohn & Hellerman	Collins & Kalinsky 1977
<i>Synedra notha</i> Hohn & Hellerman	Patrick & Reimer 1966

Name	Publication
<i>Synedra obtusa</i> W. Smith	Boyer 1927a
<i>Synedra ostenfeldii</i> (Krieger) A. Cleve	Stoermer et al. 1999
<i>Synedra oxyrhynchus</i> Kützing	Boyer 1927a
<i>Synedra oxyrhynchus</i> var. <i>undulata</i> Grunow	Patrick & Reimer 1966
<i>Synedra parallelogram</i>	Patrick & Reimer 1966
<i>Synedra parasitica</i> (W. Smith) Hustedt	Camburn 1982
<i>Synedra parasitica</i> var. <i>subconstricta</i> (Grunow) Hustedt	Camburn 1982
<i>Synedra parvula</i> Kützing	Boyer 1927a
<i>Synedra pulchella</i> Ralfs ex Kützing	Camburn 1982
<i>Synedra pulchella</i> var. <i>abnormis</i> Macchiati	Boyer 1927a
<i>Synedra pulchella</i> var. <i>flexella</i> Boyer	Boyer 1927a
<i>Synedra pulchella</i> var. <i>lacerata</i> Hustedt	Camburn 1982
<i>Synedra pulchella</i> var. <i>lanceolata</i> O'Meara	Whitford & Schumacher 1973
<i>Synedra pulchella</i> f. <i>major</i> Grunow in Van Heurck	Patrick & Reimer 1966
<i>Synedra recava</i> Hohn	Patrick & Reimer 1966
<i>Synedra radians</i> Kützing	Camburn 1982
<i>Synedra rumpens</i> Kützing	Camburn 1982
<i>Synedra rumpens</i> var. <i>familiaris</i> (Kützing) Hustedt	Camburn 1982
<i>Synedra rumpens</i> var. <i>fragilarioides</i> Grunow	Camburn 1982
<i>Synedra rumpens</i> var. <i>meneghiniana</i> Grunow	Camburn 1982
<i>Synedra rumpens</i> var. <i>scotica</i> Grunow	Camburn 1982
<i>Synedra scalaris</i> Ehrenberg	Patrick & Reimer 1966
<i>Synedra simalongis</i> W. Smith	Stoermer et al. 1999
<i>Synedra socia</i> Wallace	Collins & Kalinsky 1977
<i>Synedra spathulifera</i> Grunow	Boyer 1927a
<i>Synedra spectabilis</i>	Ehrenberg 1856
<i>Synedra splendens</i> Kützing	Boyer 1927a
<i>Synedra stauroneis</i>	Ehrenberg 1856
<i>Synedra stela</i> Hohn & Helleman	Stoermer et al. 1999
<i>Synedra subaequalis</i> (Grunow) Van Heurck	Smith 1950
<i>Synedra subrhombica</i> Nygaard	Camburn & Charles 2000
<i>Synedra subtilis</i> Kützing	H.L. Smith 1876–1888 (#579)
<i>Synedra tabulata</i> (Agardh) Kützing	Camburn 1982
<i>Synedra tabulata</i> var. <i>accuminata</i> Grunow	Drum 1981
<i>Synedra tabulata</i> var. <i>obtusa</i> (Armott) Cleve	Kaczmarek & Rushforth 1983
<i>Synedra tenera</i> W. Smith	Collins & Kalinsky 1977
<i>Synedra tenera</i> f. <i>elongata</i>	Cleve & Möller 1878
<i>Synedra tenuissima</i> Kützing	Stoermer et al. 1999
<i>Synedra ulna</i> (Nitzsch) Ehrenberg	Camburn 1982
<i>Synedra ulna</i> var. <i>aequalis</i> (Kützing) Hustedt	Camburn 1982
<i>Synedra ulna</i> var. <i>amphirhynchus</i> (Ehrenberg) Grunow	Camburn 1982
<i>Synedra ulna</i> var. <i>biceps</i> (Kützing) Kirchner	Stoermer et al. 1999
<i>Synedra ulna</i> var. <i>capitata</i> Ehrenberg	Patrick & Reimer 1966
<i>Synedra ulna</i> var. <i>chaseana</i> Thomas	Stoermer et al. 1999
<i>Synedra ulna</i> var. <i>claviceps</i> Venkataraman	Stoermer et al. 1999
<i>Synedra ulna</i> var. <i>constricta</i> Venkataraman	Hohn 1961
<i>Synedra ulna</i> var. <i>contracta</i> Østrup	Camburn 1982
<i>Synedra ulna</i> var. <i>danica</i> (Kützing) Van Heurck	Camburn 1982
<i>Synedra ulna</i> var. <i>delicatissima</i>	Patrick & Reimer 1966
<i>Synedra ulna</i> var. <i>impressa</i> Hustedt	Stoermer et al. 1999
<i>Synedra ulna</i> var. <i>impressa</i> f. <i>contracta</i>	Patrick 1968
<i>Synedra ulna</i> var. <i>lanceolata</i> Grunow	Tempère & Peragallo 1908
<i>Synedra ulna</i> var. <i>longissima</i> (W. Smith) Brun	Collins & Kalinsky 1977
<i>Synedra ulna</i> var. <i>obtusa</i> Van Heurck	Collins & Kalinsky 1977
<i>Synedra ulna</i> var. <i>oxyrhynchus</i> (Kützing) Van Heurck	Camburn 1982
<i>Synedra ulna</i> var. <i>oxyrhynchus</i> f. <i>mediocontracta</i> (Forti) Hustedt	Whitford & Schumacher 1973
<i>Synedra ulna</i> var. <i>radians</i>	Patrick & Reimer 1966

Name	Publication
<i>Synedra ulna</i> var. <i>ramesi</i> (Héribaud) Hustedt	Camburn 1982
<i>Synedra ulna</i> var. <i>spatulifera</i> Grunow	Collins & Kalinsky 1977
<i>Synedra ulna</i> var. <i>splendens</i> Kützing	Collins & Kalinsky 1977
<i>Synedra ulna</i> var. <i>subaequalis</i> (Grunow) Van Heurck	Rushforth & Squires 1985
<i>Synedra ulna</i> var. <i>vitrea</i> Van Heurck	Tempère & Peragallo 1908
<i>Synedra utermohlii</i> Hustedt	Stoermer et al. 1999
<i>Synedra valens</i> Ehrenberg	Patrick & Reimer 1966
<i>Synedra vaucheriae</i> Kützing	Boyer 1927a
<i>Synedra vaucheriae</i> var. <i>capitellata</i> (Grunow) Cleve	Stoermer et al. 1999
<i>Synedra vaucheriae</i> var. <i>truncata</i> (Greville) Grunow	Stoermer et al. 1999
<i>Synedra vitrea</i> Kützing	Boyer 1927a
<i>Tabellaria binalis</i> (Ehrenberg?) Grunow	Boyer 1927a
<i>Tabellaria fenestrata</i> (Lyngbye) Kützing	Camburn 1982
<i>Tabellaria fenestrata</i> var. <i>asterionelloides</i> Grunow	Stoermer et al. 1999
<i>Tabellaria fenestrata</i> var. <i>geniculata</i> A. Cleve	Stoermer et al. 1999
<i>Tabellaria fenestrata</i> var. <i>gracilis</i> Meister	Patrick & Reimer 1966
<i>Tabellaria fenestrata</i> var. <i>intermedia</i> Grunow	Stoermer et al. 1999
<i>Tabellaria flocculosa</i> (Roth) Kützing	Camburn 1982
<i>Tabellaria flocculosa</i> var. <i>linearis</i> Koppen	Stoermer et al. 1999
<i>Tabellaria nodosa</i>	Ehrenberg 1856
<i>Tabellaria quadrisepata</i> Knudson	Stoermer et al. 1999
<i>Tabellaria silicula</i>	Ehrenberg 1856
<i>Tabellaria teilingii</i>	Patrick & Reimer 1966
<i>Tabellaria trinodis</i> Ehrenberg	Stoermer et al. 1999
<i>Tabellaria venter</i> Ehrenberg	Patrick & Reimer 1966
<i>Tabellaria ventricosa</i> Kützing	Aubert Le Diatomiste #20
<i>Tabellaria vulgaris</i> Ehrenberg	Patrick & Reimer 1966
<i>Tabularia fasciculata</i> (C. Agardh) Williams & Round	Stoermer et al. 1999
<i>Terpsinoe americana</i> (Bailey) Ralfs	Boyer 1927a
<i>Terpsinoe intermedia</i> Grunow	Kaczmarek & Rushforth 1983
<i>Terpsinoe musica</i> Ehrenberg	Stoermer & Kreis 1978
<i>Tetracyclus elliptica</i> (Ehrenberg) Grunow	Patrick & Reimer 1966
<i>Tetracyclus emarginatus</i> (Ehrenberg) W. Smith	Patrick & Reimer 1966
<i>Tetracyclus lacustris</i> Ralfs	Patrick & Reimer 1966
<i>Tetracyclus rupestris</i> (A. Braun) Grunow	Stoermer & Kreis 1978
<i>Tetracyclus stella</i> Ehrenberg	Tempère & Peragallo 1909
<i>Tetracyclus rhombus</i> var. <i>maxima</i>	Tempère & Peragallo 1909
<i>Tetragramma americana</i>	Ehrenberg 1856
<i>Thalassiocyclus lucens</i> Håkansson & Mahood	Stoermer et al. 1999
<i>Thalassiosira bramaputrae</i> (Ehrenberg) Håkansson & Locker	Stoermer et al. 1999
<i>Thalassiosira fluviatilis</i> Hustedt	Stoermer & Kreis 1978
<i>Thalassiosira guillardii</i> Hasle	Stoermer et al. 1999
<i>Thalassiosira incerta</i> Makarova	Stoermer et al. 1999
<i>Thalassiosira lacustris</i> (Grunow) Hasle	Stoermer et al. 1999
<i>Thalassiosira levanderi</i> Van Goor	Stoermer & Kreis 1978
<i>Thalassiosira pseudonana</i> Hasle & Heim	Stoermer & Kreis 1978
<i>Thalassiosira simplex</i> Hustedt	Stoermer et al. 1999
<i>Thalassiosira visurgis</i> Hustedt	Stoermer & Kreis 1978
<i>Thalassiosira weissflogii</i> (Grunow) Fryxell & Hasle	Camburn 1982

Name	Publication
Triceratium jensenianum Grunow	Collins & Kalinsky 1977
Triceratium solenoceros Ehrenberg	Collins & Kalinsky 1977
Triceratium venosum Brighton	Collins & Kalinsky 1977
Tropidoneis lepidoptera (Gregory) Cleve	Stoermer & Kreis 1978
Tropidoneis lepidoptera var. proboscidea Cleve	Stoermer & Kreis 1978
Tropidoneis vitrea (W. Smith) Cleve	Rushforth & Merkley 1988
Tropidoneis vitrea var. scaligera (Grunow) Cleve	Rushforth & Merkley 1988
Tryblionella acuta (Cleve) D.G. Mann	Stoermer et al. 1999
Tryblionella angustata W. Smith	Stoermer et al. 1999
Tryblionella angustata var. acuta (Grunow) Bukhtiyarova	Stoermer et al. 1999
Tryblionella apiculata Gregory	Stoermer et al. 1999
Tryblionella debilis (Arnott) Grunow in Cleve & Grunow	Stoermer et al. 1999
Tryblionella gracilis W. Smith	Stoermer et al. 1999
Tryblionella hungarica (Grunow) D.G. Mann	Stoermer et al. 1999
Tryblionella levidensis W. Smith	Stoermer & Kreis 1978
Tryblionella plana var. fennica (Hustedt) Simola	Siver et al. 2005
Tryblionella scutellum (Bailey) W. Smith	Stoermer & Kreis 1978
Tryblionella victoriae Grunow	Stoermer et al. 1999
Ulnaria ulna (Nitzsch) Compère	Siver et al. 2005
Urosolenia eriensis (H.L. Smith) Round & Crawford	Stoermer et al. 1999
Urosolenia gracilis (H.L. Smith) Andresen et al.	Andresen et al. 2000
Urosolenia longiseta (Zach.) Edlund & Stoermer	Stoermer et al. 1999
Vanheurckia rhomboides (Ehrenberg) Brébisson	Patrick 1945
Vanheurckia rhomboides var. amphipleuroides (Brébisson) Van Heurck	Patrick 1945
Vanheurckia rhomboides var. crassinervia (Brébisson) Van Heurck	Patrick 1945
Vanheurckia rhomboides var. crassinervia f. capitata Patrick	Patrick 1945
Vanheurckia viridula Brébisson	Tempère & Peragallo 1908
Vanheurckia vulgaris (Thwaites) Van Heurck	Patrick 1945

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Physical Geography of the Gaoligong Shan Area of Southwest China in Relation to Biodiversity

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The Gaoligong Shan mountains (Gaoligong Shan) comprise the western-most part of the Hengduan Mountain Range. They include all of the contiguous ridges west of the Nujiang River and east of the Irrawadi-Nmai Rivers and lie at the junction of the Indo-Malaya and Palearctic zoogeographic realms. The Gaoligong Shan are one of the world's most significant biodiversity hotspots outside of the tropics.

The Hengduan Mountains, of which the Gaoligong Shan are a part, are a result of the collision of the South China Block and Eurasian Plate during the late Mesozoic. During the Cenozoic, the Gaoligong Shan have also been affected by the continuing movements of the Indo-Australasian Plate and Eurasian Plates to the west of the Hengduan Mountains.

The Gaoligong Shan are characterized by a number of unusual features. Their high, contiguous ridges extend further south than do most of those of the other Hengduan Mountains. Also, their river valleys are unusually narrow and deep because they are incised into hard rock that maintains steep slope profiles. Continuing uplift, steep gradients, and swiftly flowing rivers have eroded deep gorges. The north-south orientation of the river valleys causes the Gaoligong Shan to have an unusual face aspect relative to the sun; nearly all slopes face either east or west. The deep valleys and north-south orientation of the ridges result in the region having a more moderate climate than surrounding non-mountainous areas situated at the same latitude. Because of their antiquity, the Gaoligong Shan have accumulated a high level of biodiversity. At the same time, their high elevations and deep gorges have acted as barriers to migration for most terrestrial organisms. Moreover, because of their unusual climate and many protected environments, the Gaoligong Shan provide a refugium from global climate perturbations. It is significant that the difficult terrain has, until recently, deterred extensive human habitation, thus preserving the region's biodiversity.

KEYWORDS: Gaoli Gongshan, Gaoligongshan, Hengduan Mountains, Biodiversity Hotspot, Climate, Refugia, Indian Plate, Australasian Plate, Eurasian Plate, Tibetan Plateau, GIS, Conservation, Biogeography.

The Gaoligong Shan mountains (GLGS) are widely acknowledged as an important center of biodiversity and as such have been recognized as a World Heritage Site (UNESCO 2003). The listing recognizes the region's unusual geological context, ecological diversity, and scenic beauty. Although many authors have written about the GLGS, there is no general agreement as to the geographical definition of the region. This paper presents such a definition.

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Ecologists recognize that the interplay of many factors is responsible for the accumulation of biodiversity. The prime factor is the environmental gradient produced by latitude and its effect on trophic production. The effect of latitude is modified by elevation and climatic variation due to local factors and ecological niche structure and complexity. The degree of isolation of the environment controls interchange of species along the trophic levels. The age of the environment and its biotic components also promote biotic heterogeneity. Competition and predation interact with the niche structure to form biotic communities with various degrees of complexity. Generally, the older and more stable the area, the greater the biodiversity. Many aspects of mountain ecology serve to exaggerate the complexity of niche structure. Although many authors have alluded to different aspects of the ecology of the GLGS, none has reviewed them comprehensively in terms related to the physical geography. In this paper, the relationship of geography to ecology is investigated with respect to the promotion and maintenance of biodiversity.

In addition, the region's plate tectonics and geology are described. These two factors explain how the physical geography of the GLGS evolved. Tectonics causes rocks from different places to be brought together, building mountains or creating areas of subduction. The composition of the rocks dictates how they will behave as they are uplifted and eroded. Erosion of rocks contributes to soil formation, and the kind of soil formed is, in part, dependent on geology. The soils of the GLGS, therefore, are reviewed because of their bearing on biodiversity. The conformation of mountains and rivers has important biological consequences for the high levels of biodiversity in GLGS.

GENERAL CONSIDERATIONS

The purpose of this paper is to define the GLGS more accurately than has been done previously. This requires a starting point. Broadly speaking, the GLGS, as referred to here, are the most westerly ridges of the Hengduan Mountains that extend north to south between the Nujiang River in the east and the Irrawadi River in the west.

The name Gao-Li-Gong-Shan¹, strictly speaking, applies to a single peak at the junction of Baoshan, Lushui, and Tengchong Counties at approximately 25.133°N, 98.716°E. The exclusive

¹ In contracting Chinese names, I have used the established method of Zhao (1986) who suggested that names should not be contracted to less than two characters using the example of the Tian Shan Mountains, which he thought was preferable to Tian Mountains even though Shan means Mountains. Similarly, here I use Nujiang River rather than the Nu River despite the fact that "jiang" means river. This follows the most common usage of the name in the non-Chinese literature.

The name Gaoligong Shan in Chinese is complicated. It, like many Chinese names, has different layers of meaning. It can mean, literally, and based on the characters alone, High Multitude Tribute Mountain. The character Li that is used, is the same as the one used for the transliteration Li in the name of the people called Lisu and who are the dominant ethnic minority group of the area. The exclusive usage in Chinese is that Gaoligong Shan implies the whole range of which Mount Gaoligong Shan is in the middle. The alternative term that could be used is Shanmai, which means mountain range in Chinese. This would give the rather cumbersome and never used term Gaoligong Shanmai or more correctly, but even worse sounding, Gaoligong Shan Shanmai. In this paper, the name used for the whole range will also be Gaoligong Shan (GLGS); I recommend that alternative names, sometimes seen in print, should be avoided, e.g. "Gaoli's," "Gaoligong," "Gaoli Gongshan," or just "Gongshan." "Mount Gaoligong Shan" should be used for the single peak if needed.

Another point: names in this region are difficult because of diverse ethnicities and dialects, e.g., the commonly referred to name Gongshan, is used sometimes for the mountains, at other times the county seat for the administrative zone, and most often, as an abbreviation for an administrative zone itself. This is the Gongshan Dulong Nuzu Zizhixian. Sometimes the Gongshan administrative zone is referred to as the Dulong area. Officially, it should be the Gongshan Drungzu Nuzu Zizhixian (Carto. Pub. Hse 1984), and in this paper it will be referred to as (Gongshan County), Drung, Dulong, and even Delung are the name for same people but spelled in different dialects. The name used can have many implications (Gros 2004). In this paper, place names are given to be as informative as possible to the general reader (see also cartography section in the main text). Lastly, GLGS is used in the plural to signify the whole range, as we do for the Rocky Mountains of the western United States.

Carto. Pub. Hse (1984). *Map of the People's Republic of China*. Cartographic Publishing House, Beijing; Esselte Map Service AB, Sweden.
Gros, S. (2004). The Politics of Names: The Identification of the Dulong (Drung) of Northwest Yunnan. China Information. *The Documentation and Research Centre for Modern China, Sinological Institute, Leiden University* 18(2):275-302.

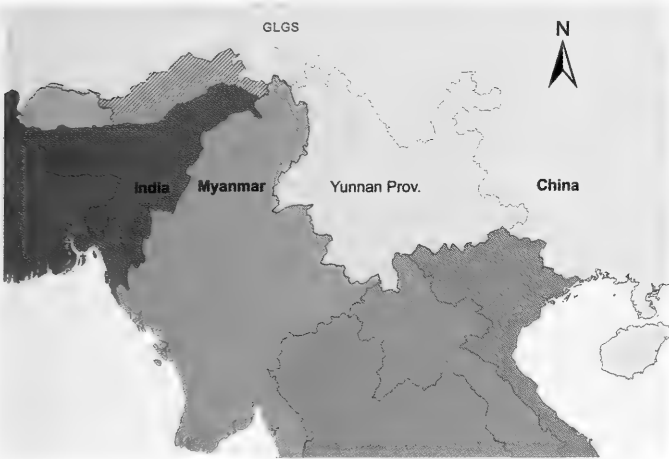


FIGURE 1. Regional locator map showing the Gaoligong Shan highlighted in relation to political geography.

usage in Chinese is that Gaoligong Shan includes the whole range of mountains of which the peak named Gaoligong Shan is in the middle. Chinese does not distinguish between plural and singular.

The GLGS are a poorly known biodiversity hotspot in Southwest China located mostly in Yunnan Province. They are the most biodiversity-rich area (Lan and Dunbar 2000; Mackinnon et al. 1996) of Yunnan, which is China's most biodiverse province (Zhang and Lin 1985) (see Figs. 1 and 2). The GLGS occupy about 10.5% of Yunnan Province.

The GLGS are a rugged mountainous border region adjoining Myanmar on the northeast. From a biogeographic perspective, the GLGS form the junction of several biogeographical realms, the Indo-Malayan, and Palearctic, and the biogeographical provinces of the Tibetan Plateau and South China subregion. The GLGS also stand at the junction of three major tectonic plates, which are discussed below, and, thus, three geological provinces. This position has given them an interesting and complex geological structure.

The formation of the Hengduan Mountains, of which the GLGS are a part, preceded the uplift of the Qinghai-Xizang (Tibetan) Plateau. However, today the GLGS are, more or less, an extension of the Tibetan Plateau, which extends far to the south into Yunnan (see shaded area in Fig. 3). Subsequent to the uplift of the Plateau, the Hengduan Mountains and GLGS

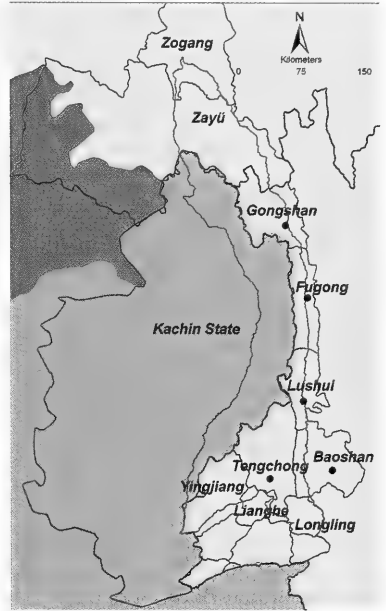


FIGURE 2. Locator map showing the Gaoligong Shan highlighted in relation to local political geography.

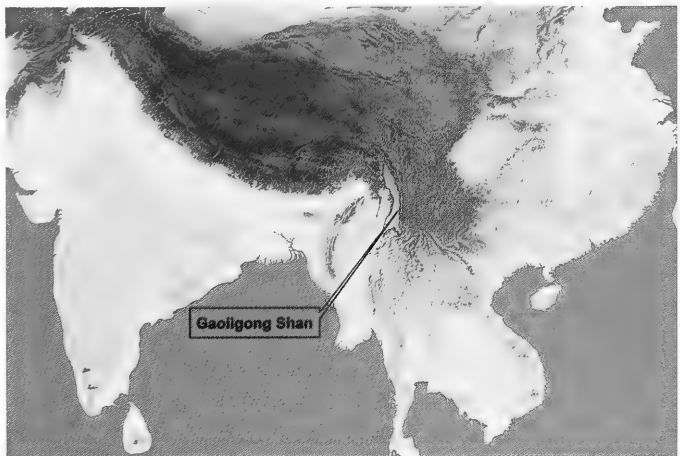


FIGURE 3. Regional locator map showing the Gaoligong Shan highlighted in yellow to the south of the Tibetan Plateau and to the west of the rest of the Hengduan Mountains.

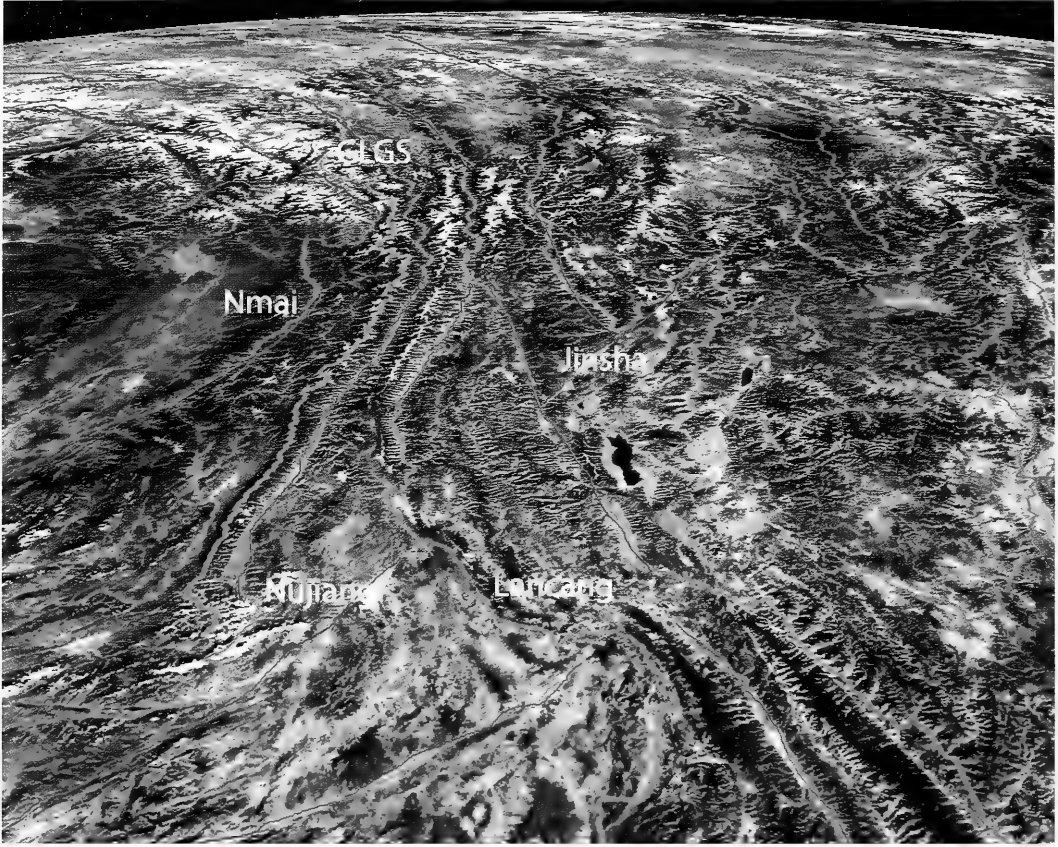


FIGURE 4. Satellite Image of Hengduan Mountains centered on Mt Gaoligong Shan. the Nujiang River can be seen entering the snow covered Tibetan Plateau at the top of the image (NASA 2004a).

experienced uplift, which has continued throughout much of the Cenozoic, and is associated with the Himalayan orogeny. The region is divided by a few large north-south flowing rivers, which are of major importance to Southeast Asia. The rivers run in extremely deep, gorges, which, having cut into the uplifting mountainous area, gave rise to a series of narrow, north-south-oriented, high mountain ridges. The rivers, which are associated with major fault zones (see Fig. 4), divide the area biogeographically.

TECTONICS

The north-south orientation of the Hengduan Mountains is orthogonal to the predominant east-west mountains found throughout eastern Eurasia. The Chinese name "Hengduan" translates as the "Transverse" or "Transecting" Mountains. The GLGS comprise the most westerly mountain ridge of the Hengduan Mountains.

EARLY TECTONIC MOVEMENTS.— The Hengduan Mountains were formed by several different major tectonic events. The mountains are at the margins of several plates, the Eurasian Plate to the north, the Indochina Block to the south, and the Indian Plate to the west. These plates are constrained by the Philippine-Pacific Plates to the east, and the Australasian Plate to the south (Hall 1997). These plates are all moving relative to the stable Eurasian Plate. The Hengduan Mountains region, being at the plate margins, is an active earthquake zone.

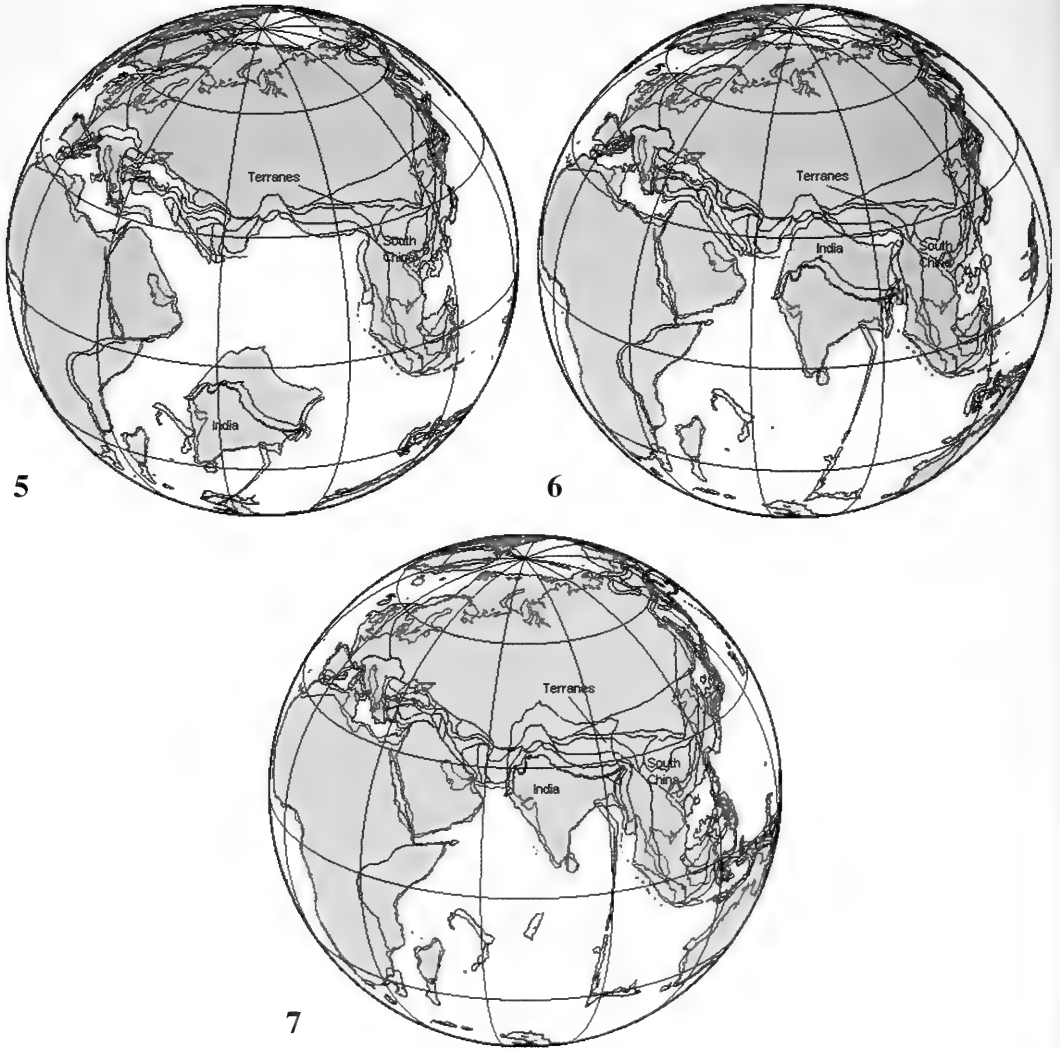
The very earliest collision involved the subduction of plate fragments (blocks or terranes), including the Southern China Block, which were driven north and eastwards by the Philippine/Pacific Plates after they broke away from Pangea and Gondwana. These older movements underlie the eastern part of the Hengduan Mountains in northern Sichuan and their extension along the Longmen Mountains. From the initial breakup of Pangea, in the early Carboniferous between 350 to 300 Mya, the South China Block was always slightly ahead of the Indochina Block as both moved northwards. Nonetheless, the two were always closely associated. The Southern China Block contacted the Eurasian Plate shortly after the Northern China Plate and before the Indochina Block; this happened as early as 200 Mya.

The Southern Terranes separated from the Northern Terranes very early, around 300 Mya. The sub-plate of the Southern Terranes broke away from Pangea much later than did the previously mentioned Plates and Blocks (South China, Indochina, and Northern Terranes). The Northern Terranes impacted the Eurasian Plate to the northwest of the South China Block. The Lhasa Terrane forms part of the GLGS and it belongs to the Northern Terrane group. The Southern Terranes managed to catch up with the Lhasa and Northern Terranes as they were slowed by collision into the Eurasian Plate. By 100 Mya, the Southern Terranes were abutting the Northern Terranes, on the south side of the Eurasian Plate and were adjoining the west side of the Hengduan Mountains. These plates can be seen in Figure 5 at 65 Mya and are already in place at that time. Figures 5–7 were produced using the web service of the Ocean Drilling Stratigraphic Network Plate Tectonic Reconstruction Service (Soeding 2004), and the general discussion follows maps produced at the History of Global Plate Motions (Dutch 1998, citing data from Scotese 1994). The Hengduan Mountains are, thus, the result of these collisions. Formerly, the upper GLGS region would have been influenced by these early tectonic movements and collisions. However, in the GLGS, any early signal has now mostly been overwritten by subsequent events.

CENOZOIC TECTONIC MOVEMENTS.— In the early Tertiary, by 55 Mya, both Northern and Southern terrane groups were enclosed by the Indian Plate to the south, the South China Block to the east, and the Eurasian Plate to the north. The closing of the Tethyan seaway north of the GLGS was achieved by the relatively fast collision of the Indian Plate with the Eurasian Plate in the early Cenozoic. Eventually, both Northern and Southern terranes were sandwiched between the Indian Plate and the Eurasian Plate and became extruded and highly deformed (see Fig. 6 at 25 Mya). The present strains on these plates change orientation in the region of the northern GLGS from north-south to east-west (Bi 2004).

The Indian Plate moves north by as much as 50 mm per year, and the area has absorbed some 1500 km of deformation since first contact between India and Eurasia (Replumaz et al. 2004). In Myanmar, the amount of annual movement is only 35 mm (Socquet and Pubellier 2003). The crustal thickness over the Tibetan Plateau is much greater than elsewhere. Remnants of ocean crust lie now just west of the GLGS in Assam and can be seen as the white patch in Figure 7. The terranes can be seen as thin strips sandwiched in between the larger plates. The congregation of plates in the region of the Hengduan Mountains can clearly be seen in Figure 7.

As a consequence of the Indian Plate's collision into the Eurasian Plate, the eastern Himalaya syntaxis rotated clockwise, and crustal fragments of the Northern and Southern Terranes extruded southeastward. The extrusion was along the NW-trending Karakoram-Jiali, N-trending Gaoligong Shan, and Sagaing Faults (Lin et al. 2004). Ages of the faults indicate that deformation may have started from the south along the Sagaing Fault in Indochina and propagated toward the north along the Gaoligong Shan Fault. Subsequently, the deformation proceeded toward the northwest along the Jiali Fault and then the Karakoram Fault in southern Tibet. Such a deformation trend reflects continuous deformation caused by the northward indentation of the Indian Plate into the Eurasian



FIGURES 5–7. (5): Reconstruction of Plate movements for 65 Mya; (6): at 25 Mya; (7): present. Present coastline is shown in red on the grey plates. White indicates sea floor. Images courtesy of Soeding (2004).

Plate, which has continued during the whole of the Tertiary (Lin et al. 2004).

The Hengduan Mountains are bound by a series of north-and-northwest-striking Cenozoic faults: to the west by the Gaoligong Shan and Batang-Lijiang strike-slip systems, to the east by the Longmen Mountain thrust belt and the Xiaojiang Fault, and to the south by the Red River fault shear zone (Wang et al. 2001). The Cenozoic deformational history of the eastern Indo-Asian collision zone may be divided into three stages: (1) Eocene-Oligocene (40–24 Myr) transpression in eastern Tibet starting in the Red River Shear Zone just below the GLGS; (2) early-middle Miocene (24–17 Myr) transtension in eastern Tibet; and (3) late Neogene-Quaternary east-west extension, widespread in eastern Tibet and Indochina, which created small basins to the east, west and south of the GLGS (Wang et al. 2001).

QUATERNARY TECTONIC MOVEMENTS.— The newest tectonic arrival, the Australasian Plate,

has driven the Indochina Block northwards, crushing and distorting the latter's northern front. The Indochina Block is highly deformed in the north but behaves approximately like a rigid block in the south (Wang et al. 2001). Secondary thrusting in the area is now active in the south of the GLGS as a result of the Australasian Plate subducting beneath Indonesia. For example, in Pupiao—a basin adjoining the GLGS along the east bank of the Nujiang River in Baoshan County—the Miocene/Pliocene soft coal beds are uplifted 70 m and tilted so that the adit entrance is at 60 degrees (pers. obs.).

The latest area to deform is south of the GLGS at the point where the Nujiang River first heads east, then south, and then southwest. The river courses of the Nanding River to the south of the study area, the Dayang, Wanding, and Longchuan Rivers run along associated en echelon faults in a newly established rupture zone. In addition, the Nujiang River is strongly diverted westwards by them. This zone of active faults dates from the Early Pleistocene. The ENE-WSW trending Longling-Lancang fault zone cuts across the earlier tectonics during the later period (Guo et al. 2000). This extensional drag possibly resulted from the orthogonal friction of the Indian Plate moving north along the middle of Myanmar (Socquet and Pubellier 2003) or from the Australasian Plate's impact along Sumatra and the Andaman Islands. The Tengchong region also exhibits a series of N-S faults, which contain the upper reaches of the Daying, Longchuan and Mingguan Rivers.

TECTONICS AND MOUNTAIN BUILDING IN THE GAOLIGONG SHAN.— The Paleozoic and Mesozoic Era plate movements resulted in faulting, folding, and the formation of metamorphic rocks and magmatite. These tectonic features were formed in the Paleozoic Era with the breakup of Pangea. The same trends continued with added impetus throughout the Mesozoic as the plates assembled on the south side of the Eurasian Plate. Then, in the Cenozoic, the extensive regional fault system was activated as a result of the collision of the Indian Plate with the Eurasian Plate, and a collage of terranes and other plate fragments. The complex tectonics of the GLGS region has resulted in extensive orogeny and erosion. It has also resulted in volcanism, extensive metamorphism, and local eruptions. And, in the GLGS, it has resulted in the uplift and exposure of rocks of much older periods. The movements of the tectonic plates and reentrant terranes were facilitated through a series of large strike-slip faults, as mentioned above. The courses of the Nujiang River, Lancang River, the northern part of the Jingsha River, and the Red River to the south, flow in these very large fault structures. The main branch of the Irrawadi River follows in the the course of another set of faults zones further to the west. The rivers have been entrained by the uplift, but, because of their huge watersheds, their large flows were sufficient to keep pace with the uplift through their down-cutting action. The Nujiang River Gorge Fault facilitates some 17 mm of slip per year along the Yunnan River Valley fault system (Socquet and Pubellier 2003), a fact highly relevant to the dams planned for the area. The constitution, trending, and formation period of the compressional, north-south older tectonics are totally different from those of east-west extensional tectonic active in the Longling-Lancang Rupture Zone that formed in the Pleistocene.

EARTHQUAKES.— As a result of extensive and ongoing tectonic activity in the Hengduan Mountains, it is an active fault zone with many earthquakes (Meyerhoff et al. 1991). To the east of the Hengduan Mountains, along a line from the Longmen Mountains to east of the Lancang River, is an active zone of large earthquakes that have registered eight and above on the Richter Scale. The Nujiang River Fault, Lancang Fault, and the Red River Rupture Zone, are strike-slip faults that register earthquake magnitudes of typically less than eight and rarely above seven. In contrast, the Yarlung Zangbo (Brahmaputra) Fault Zone, which encompasses a system of low-angle thrust faults, experiences larger earthquakes, ones that often register over eight. Strike-slip faults rupture at lower magnitudes than do thrust faults, which are usually associated with subduction boundaries.

At first, the axis of the zone of thrust faults seems to have been in Longmen Mountains but moved west to the Nujiang River in the Permian and now is along the Yarlung Zangbo fault system (Meyerhoff et al. 1991). Currently, the main thrusting activity has moved south from the Yarlung Zangbo to the Frontal and Main Boundary Thrust systems in northern India and Nepal. Large earthquakes have the potential for tectonic damming of the rivers, that is major slides that often result from earthquakes generated by fault movement. For example, this happened on the Yi'ong Zangbo River just northwest of the GLGS. There a 33-km² lake formed behind a 2500 m by 60 m high dam in 2000. The dam subsequently failed, which resulted a catastrophic flood of over 100 km in length. Evidence of such damming, and scouring floods should be visible in the river terraces if they have occurred on the Nujiang River.

BIODIVERSITY IMPLICATIONS OF TECTONICS.— The paleo-separation and subsequent reaggregation of plates from Gondwana and their eventual collision with the Eurasian Plate brought diverse biotas together from different paleo-continents. The area's complex uplift history has fostered greater genetic diversity in the region because of complex patterns of exchange, isolation, adaptation, extinctions, and speciation. Of particular importance has been geographic division due to the tectonically-driven incision of the landmass by massive rivers that has given rise to opportunities for vicariant events leading to further diversification. Tectonic activity has implications for the evolution of diverse host rock and soil types (see below).

GEOLGY

GEOLOGICAL PROVINCE OVERVIEW.— The geologic provinces of the GLGS broadly agree with the boundaries of their tectonic elements. The GLGS contain three geological provinces: (1) the Lhasa Terrane from the Northern Terrane Group, which extends from the north along the Nujiang River valley to 70 kms south of Fugong Town; (2) the Himalaya Block of the Southern Terrane Group in the northwest near the Dulong River and south to near Gongshan Town; and (3) the Tenasserim-Shan Block of the Indochina Block, which includes all of the middle and southern GLGS. The Qintang Terrane forms the eastern border to the GLGS, but it is seen within only a tiny portion of the study area near Lishadi Village just north of Fugong Town, (see Figs. 2, 8). Each province has a set of geologic characteristics that distinguishes it from surrounding provinces. These characteristics may include the predominant lithologies, the age of the strata, and the structural style (Steinshouer et al. 1997; Wandrey and Law 1997).

AGE OF THE ROCKS OF THE GAOLIGONG SHAN.— The Paleozoic Era GLGS formations are dominated by fault-, fold-, metamorphic-, and magmatite-deformed rocks. The major outcropping of Mesozoic Era rocks is more to the east of the study area along the Qintang Terrane; the rocks have been uplifted and folded, accompanied by compressional foreshortening, giving rise to the Nushan Mountains. However, smaller outcrops of Mesozoic rocks occur at both ends of the study zone (Fig. 9). To the southeast and generally along the western edge are large areas of Precambrian-age metamorphic rocks. Further to the west in the modern Burmese Basin (Myanmar), the Precambrian is overlain by Tertiary and Quaternary sediments. Many sedimentary strata in the GLGS have been lifted to being nearly vertical. The whole southern Hengduan Mountains area underwent more folding and uplift throughout the Cenozoic Era. This high degree of folding led in the southern GLGS to the exposure of older Lower Paleozoic sequences, some as early as Cambrian. Cenozoic rocks in the GLGS include further metamorphic changes to host rocks and, locally, volcanism around Tengchong Town, in the southwest and west of the GLGS in Myanmar probably reflect extensional tectonics as a result of ongoing subduction of the eastern limb of the Indian plate. Both Tertiary and Quaternary volcanics and sediments have formed in Tengchong

County. During the Cenozoic, a series of extensional basins formed and can be seen as small patches around the GLGS in Figure 9. These basins are associated with the change in thrust direction in the Plio-Pleistocene. Recent geological deposits consist of considerable scree and colluvium, alluvium, flood facies, and river terracing that can be seen in a few places in the river valleys. In the extreme north of the GLGS, there are extensive glaciers and paleoglacial features. The glaciers are shrinking at an astonishing rate, as can be seen when comparing recent satellite photographs with photos taken in the 1970s; this is probably as a result of global warming.

GENERALIZED GEOLOGY

Starting from the north, the geology of the GLGS will be examined in more detail and briefly discussed, because geology has an impact on present landforms and implications for biodiversity. The data are taken from two USGS open-file reports for Far East Asia and South Asia, respectively (Steinshouer et al. 1997; Wandrey and Law 1997). The maps presented in this paper that were derived from these data are not accurate beyond 1 km and the discussion is of regional overview or generalized geologies only.

LHASA TERRANE.— The Lhasa Terrane comprises the north of the GLGS area, in eastern Chayu County (Zayü Xian) and the southern part of Zougong County (Zogang Xian) of the Tibetan Autonomous Region (Xizang Zizhiqu). The Lhasa Terrane also forms the northwestern part of Gongshan Dulong-Nu Autonomous County of Yunnan Province (Gongshan Drungzu-Nuzu Zizhixian) (referred to herewith as Gongshan County). The Lhasa Terrane is formed into a high mountainous area of Upper Paleozoic Rocks (PZu) (Figure 10). The Upper Paleozoic Rocks in general within the GLGS consist of intercalated beds of carbonate, argillaceous deposits, basalts, and metamorphosed rocks with the upper facies containing more volcanics. The Lhasa Terrane is flanked to the northwest (north of the Dulong

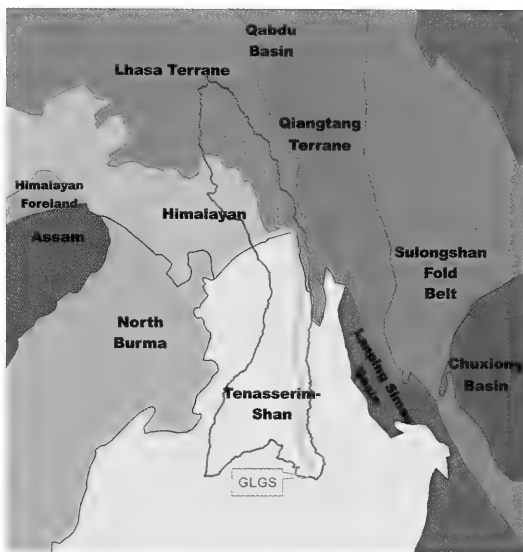


FIGURE 8. Map of the Geological Provinces within the Gaoligong Shan; these provinces broadly agree with the positions of tectonic plates (data from Steinshouer et al. 1997, Wandrey and Law 1997).

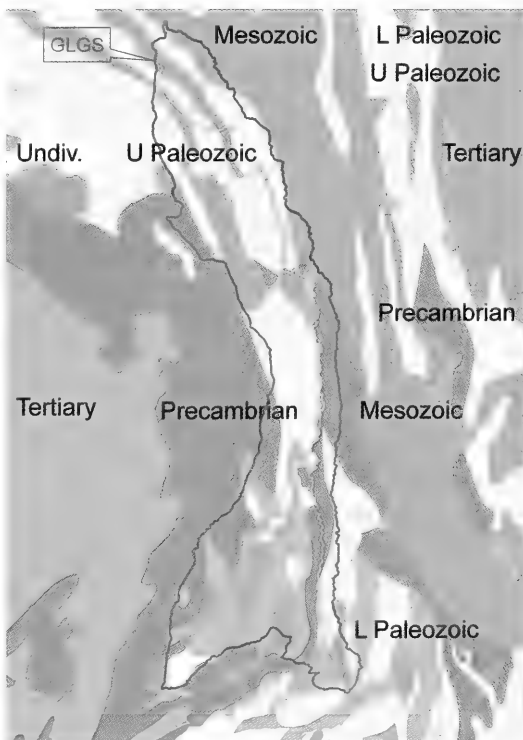


FIGURE 9. Geologic Map of the Gaoligong Shan showing the geologic age of the strata.

River) by Jurassic- Cretaceous (JK) age sequences. These sequences occur to the east where beds of Jurassic-Cretaceous age form the course of the Nujiang River. In the finger of the terrane extruded towards the town of Fugong, the river cuts through the Triassic (Tr) beds of the Lhasa or Qintang Terrane. Beyond, the Nujiang River reaches the Precambrian (pC) beds, which consist of some paratethys and some metamorphic and basaltic rocks. These Precambrian rocks form most of the ridge of the GLGS. The Precambrian metamorphics also form the ridges in the extreme west of Gongshan County and part of the ridge of the Patkai Range. The Patkai Range and other ridges in Myanmar are not part of the GLGS and lie outside of the study zone. Small patches of these Precambrian rocks are also exposed at the junction of the Himalaya Block, Lhasa Terrane, and the Tenasserim-Shan Block near to the town of Gongshan.

HIMALAYAN BLOCK.— The Himalayan Block forms the southwest of Zayü County and forms all of the eastern part of Gongshan County west of the Dulong River watershed. The mountains of the Himalaya Block are lower than those of the Lhasa Terrane. The Himalayan Block is formed mostly of Mesozoic intrusive and metamorphic rocks (Mzim). The Himalayan Block also extends across the northern end of the Tenasserim-Shan Block to form the finger that is caught between the Tenasserim-Shan Block and the Lhasa Terrane. This finger is formed of Triassic metamorphic and sedimentary rocks (Trms), possibly a shallow sea ophiolitic melange. To the west, mostly outside of the study area, in the northwest corner of Gongshan County, there are extensive areas of Precambrian (pC) rocks belonging to the Himalaya Block. Between these and the metamorphic core of the Himalaya Block in Gongshan County is a flank of Carboniferous sedimentary rocks (Cs). On the other flank, between the westerly edge of the Himalaya Block and the Lhasa Terrane, are small outcroppings of Permian sedimentary rocks, probably consisting of deep-water turbidites (Meyerhoff et al. 1991).

TENASSERIM-SHAN BLOCK.— MAIN RIDGE OF THE GAOLIGONG SHAN IN FUGONG, LUSHUI, AND KACHIN.— The majority of the GLGS sits on the Tenasserim-Shan Block. The middle reach-

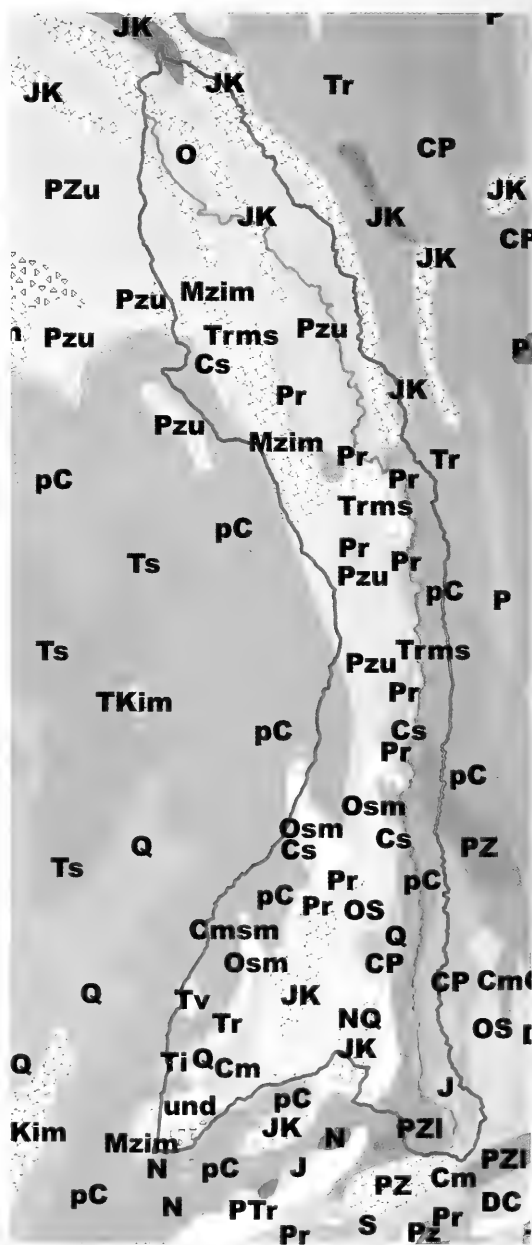


FIGURE 10. Map showing the geologic units in the Gaoligong Shan.

es of the GLGS comprise Fugong and Lushui Counties and to the west, Kachin State of Myanmar. The middle reaches of the GLGS ridge are in the northern part of the Tenasserim-Shan Block that extends south from the border with Gongshan County and the Himalaya Block. The GLGS main ridgeline skirts around the northern edge of Triassic metamorphic and sedimentary rocks (Trms) and runs south through the middle reaches between Precambrian (pC) on the east and Permian (Pr) and more Triassic metamorphic and sedimentary rocks (Trms). The Permian beds have more Tethyan affinities. To the west, the middle reaches of the GLGS are formed of Upper Paleozoic rocks (PZU). The actual ridge and the eastern flank of the GLGS are formed of Precambrian (pC) rocks. Small Carboniferous sedimentary (Cs) bodies pop out in the southern part of the middle section together with a larger Ordovician sedimentary outcrop, mostly grapholitic shales and metamorphic rocks (Osm), probably composed of flysch and paraflysch. At the southern end of the middle section, in Lushui County, occurs the end of the highest peaks where the ridgeline is above 3500m.

TENASSERIM-SHAN BLOCK: MAIN RIDGE OF THE GAOLIGONG SHAN IN BAOSHAN PREFECTURE.— In the whole of the southern part of the GLGS, the main ridgeline is in Baoshan Prefecture. To the east of the main Ridgeline, the rocks are mostly Precambrian (pC). There are also outcrops of undifferentiated Paleozoic age of in northern Baoshan Prefecture; south of these are rocks of Carboniferous and Permian (CP) age. Around Daxue Mountain in Longling County in the south of Baoshan Prefecture, there are Lower Paleozoic rocks (PZI). At the eastern foot of Daxueshan at the southern extremity of the GLGS main ridgeline, in southeastern Longling County, is a Jurassic (Jr) intrusion. The Nujiang River flows east of this in a Silurian and Ordovician (SO) region between Longling and Shidian Counties. The western slope from the main GLGS ridge in Tengchong County down to the height of the Tengchong Basin is again Precambrian (pC) south to the Longchuan River. To the south of the Longchuan River in Longling County, the western and southern slopes of the main GLGS ridge are Lower Paleozoic rocks (PZI).

TENASSERIM-SHAN BLOCK: “NE-SW TRENDING RIDGES” OF MYANMAR, AND THE COUNTIES OF TENGCHONG AND LONGJIANG.— Because these ridges do not have a collective name, hereafter I will refer to them as the “NE-SW Trending Ridges.” Between Lushui and Tengchong Counties, the border of China moves away from the GLGS main ridgeline into Myanmar along a line of high “NE-SW Trending Ridges.” These ridges extend from Lushui County Line near Lushui Town towards Jianga Mountain and continue further for 140 kms into Yingjiang County. The tectonic influences in the southern part and to the west are considerably younger, and have a tighter fold and fault structure imposed on the area. In the Myanmar part of the GLGS, there has been less uplift. Below Lushui County, the rock types become numerous, with smaller outcroppings. In the southern part of the GLGS south of Lushui County, there are similar sequence motifs between the western branch of “NE-SW Trending Ridges” and the eastern branch of the GLGS main mountain ridge, although the rock sequences are not identical.

The westernmost flank of the “NE-SW Trending Ridges” is composed of rocks of Precambrian (pC) age. North of Tengchong County in Myanmar are Ordovician sedimentary and metamorphic (Osm) rocks, and southwest of these are more Carboniferous sedimentary (Cs) rocks. The Precambrian rocks return to be replaced further southwest by a small body of Cambrian (Cmsm) sediments and metasediments. Next to these Cambrian beds are more Ordovician sedimentary and metamorphic (Osm) rocks. The Precambrian makes up the south-westernmost corner of the GLGS ridges, except for inclusions of various igneous rocks. These parts of the “NE-SW Trending Ridges” are all in the Myanmar part of the GLGS.

The eastern flank of the “NE-SW Trending Ridges” in northern Tengchong County is Ordovician/Silurian (OS) and Permian (Pr). In western Tengchong and Yingjiang Counties, the

eastern slopes of the “NE-SW Trending Ridges” are composed of Jurassic, Cretaceous, Triassic and other undifferentiated Mesozoic igneous rocks. West of these are small outcroppings of Tertiary volcanics, namely basaltic flows, andesitic lavas and pyroclastics, which overlie the Precambrian (pC) rocks that form the ridges of the “NE-SW Trending Ridges” in Myanmar. Just south of this, and slightly to the east in Yingjiang County, is an outcrop of Triassic (Tr) rocks along the border between Yunnan and Myanmar and the east flank of the “NE-SW Trending Ridges.”

TENASSERIM-SHAN BLOCK: CENTRAL BASIN AREA OF YINGJIANG, LONGCHUAN, AND TENGCHONG COUNTIES.— The area between the eastern flank of the “NE-SW Trending Ridges” and the western flank of the main ridgeline of the GLGS is a raised area dissected by the Daying and Longchuan Rivers and their tributaries. Running NE-SW down the middle of the area is a spine of Ordovician Silurian rocks that separates the drainage of the two rivers. There is a series of N-S to NE-SW trending faults that split the central area of Tengchong County from the “NE-SW Trending Ridges” down to the Longchuan River. These open up the Tengchong Basin into a “fan-folded” series of mountainous ridges. The upper headwaters of the Dayang and Longchuan Rivers and their tributaries like the Mingguan River run along these fault lines. These can be best seen in Figure 10.

To the east of the Triassic igneous rocks, which occur along the border with Myanmar, there are Cambrian (Cm) and Silurian and Ordovician (SO) rocks, which extend towards the Longchuan River. To the east of the Longchuan River and north to the region of Tengchong Town, the area is mostly filled with Mesozoic beds of Jurassic-Cretaceous (JK) age, although these are extensively overlain by Neogene and Quaternary volcanic deposits and some younger volcanically-derived sediments. Tengchong County is characterized by a horseshoe-shaped opening to the south composed of Neogene sediments surrounding the Jurassic-Cretaceous mountains. The central region of Tengchong and eastern Yingjiang Counties is probably a zone of extension along the *en echelon* fault system that extends from here and further south. These younger faults cut across the older tectonic imprint (Guo et al. 2000). This extension would have exposed different rocks, as well as having allowed infilling by volcanic activity and for sedimentation to have taken place. These form the Quaternary Tengchong Basin, which appears to have subsequently uplifted. The Tengchong County pyroclastic cone field is not shown on Figure 10. It covers 600 km² and has erupted in five phases since the Tertiary. The nature of the eruption has changed from andesitic lavas in the early Tertiary to olivine-rich basalt lavas during the Pliocene through to the present. Daying Mountain Crater, 2865 m at 25.32°N, 98.47°E, last erupted in 1609 in an explosive eruption (Smithsonian 2005). The many preserved cones in this area could be a source of local adaptation and vicariant speciation of smaller organisms.

SOILS

The heterogeneity of soils in the GLGS is a consequence of the region’s geologic diversity. The variety of host rocks, of very different ages, has given rise to many soil types. Although the remotely sensed data for this region are rather coarse (1:4 M), some different dominant soil types are observable (F.A.O. 2005). The existence of many host rocks with different suites of predominant minerals and a multitude of microclimates ensure a much greater diversity of soils on the ground than has been actually mapped. Within the study area, there exists a variety of soils with pH that varies from limestone-derived alkali types to acidic ones.

In the north, on the Himalaya Block, are found the following lithosoils, humic cambisol, and eutric cambisol west of the Dulong. From the Lhasa Terrane in the north along the entire eastern slope and ridge of the GLGS are calcareous fluvisols. The western slope from the northern to the northwestern part of Tengchong County has lithosol and humic cambisol. These continue south

from Tengchong County along the western slope of the main GLGS ridge. In southwestern Tengchong and northern Yingjiang Counties are orthic Acrisols. A tongue between them, from the central part of Tengchong County south until the Longling County border, is composed of ferric Acrisol. The very southern portion of the study area in Longling County exhibits a more developed orthic Acrisol (F.A.O. 2005). The predominant agricultural soil types seem to be Latosols, Laterite, red earths, yellow earths, purple earth, and paddy soils (F.A.O. 2005). These are mostly alluvial terraces derived from the material of calcareous sedimentary rock, although the orthic Acrisols are more acidic (F.A.O. 2005).

Soils evolve according to the latitude, elevation, temperature, and rainfall regime in which they are distributed. The same host rock minerals will give rise to different soils depending on the environment. Soil diversity, in turn, gives rise to floristic diversity and, ultimately, is another source of biodiversity. The soils at the two ends of the GLGS range are quite different. The great range of host rocks, elevation, latitude, and monsoon conditions within the GLGS gives rise to considerable soil diversity, hence contributing to the region's biodiversity.

HYSOGRAPHY AND LANDFORM ANALYSIS

The size of physical geographic structures in the Hengduan Mountains is large and the component ranges or ridges can extend hundreds of kilometers. The GLGS are the most southerly reaching of the major ranges. Each range can have many names where it crosses ethnic boundaries. These names will be given from north to south and will be abbreviated to that shown in brackets. (1) the most easterly transverse ridge being the Ninjingshan-Yunling-Qingshuilangshan (Yunling Mountains), which form the eastern bank of the Lancang River; (2) between the Lancang and the Nujiang Rivers is the Taniantawenshan-Nushan Ridge (Nushan Mountains); and (3) the most westerly ridges of the Hengduan Mountains are the GLGS, with the "NE-SW Trending Ridges" of Jianga Mountain extending into the Kachin State of Myanmar. The Shannghwa Range west of the Nmai and Tamai Nmai Rivers is not considered part of the Hengduan Mountains. Neither is the next ridge beyond the Mali River, the Kumon Range. The transverse ridge joining these Myanmar ranges in the north (the Patkai Mun Range between upper Myanmar and Assam) is not part of the GLGS.

NORTHERN LIMIT OF GAOLIGONG SHAN.— The upper GLGS are separated from the eastern Himalayas by a major tributary of the Yarlung Zangbo River (Brahmaputra), the San Qu River (Luhit River in Assam, also known as the Sang Qu and Zayü Qu River further north). This tributary extends as far as the Zayü County and Zogang County border. A few kilometers to the north of the Zayü Qu rise the Parlung River and Yi'ong Zangbo River, other tributaries of the Yarlung Zangbo River (Brahmaputra). North of this area, the Nushan Mountains loop over the northern end of the GLGS. The most southerly of the mountain ranges of the Tibetan Plateau, the Nyainqetanglashan, are just north of the Yarlung Zangbo River (Brahmaputra). These are separated from the GLGS by a river that is a tributary of the Nujiang River to the east. This tributary almost joins the drainage of the Parlung and Yi'ong Zangbo Rivers south of Bomi Town to the upper course of the Sang Qu River (Luhit). These mark the northwestern river boundary of the GLGS. Together they form a high valley between the Nyainqetanglashan and the GLGS, near Baxoi Town, well south of Qamdo. At Baxoi Town, the most southerly road from Sichuan Province and Lijiang City, Yunnan passes into eastern Zayü County towards towns of Gyigang and Zayü. This is just north of the Diphu Pass above the headwaters of the Tamai Nmai River. The Diphu Pass marks the boundary of the Patkai Range and the GLGS. All these structures combine to make a break in the GLGS that clearly separate it from its higher neighbors. Many of the peaks in the upper

Nushan Mountains and eastern Himalaya are 7000 m plus. These physical features can be seen in the elevation perspective model (see Figs. 11–13 and the satellite image, Fig. 14).

SOUTHERN LIMIT OF GAOLIGONG SHAN.— The southern boundary of the GLGS is clearly defined. The GLGS end where the main ridge ends in an encirclement by the Nujiang River to the east, south and west, and its tributary the Supa River. The Supa River rises off the northwest side of the main GLGS ridge on Daxue Mountain— near the village of Zhen'an. The Supa River runs northeast of the city of Longling to join the Nujiang River north of Pingda. This tributary is almost met by the Mangshi River, a tributary of the Longchuan and Irrawadi Rivers, which rises just southwest of Longling Town. To the west of this promontory are the NNE-SSW ridges of the low mountains within Luxi County that meet the GLGS ridge just north of Longling Town. These are separated from the GLGS by a saddle between the aforementioned rivers. These physical features can be seen in the elevation perspective model (Figs. 15–17) and satellite image (Fig. 18).

LAND FORM OF GAOLIGONG

SHAN.— The elevational nature of physical features is the result of the interplay between tectonic, geologic, and natural erosional forces. High mountains are formed by tectonics and are maintained either by hard rocks and slow erosion, ongoing tectonic actions, or both. Harder rocks make for steeper slopes and more bare outcrops. Rain, wind, and ice work together with gravity to reverse tectonic uplift. The steep mountains in this area result from ongoing uplift, and the hard nature of their rock. Despite the fact that rainfall in the area is considerable and biotic productivity high, soil formation and rock decomposition are unable to wear down the mountains fast enough.

As noted above, the majority of high ground is formed from the Precambrian rocks, mostly metamorphics. The main ridge of the GLGS runs due N-S and is composed primarily of these



FIGURE 11. Perspective view of the Gaoligong Shan from the north looking towards the southeast. Main ridgeline shown as a yellow line.

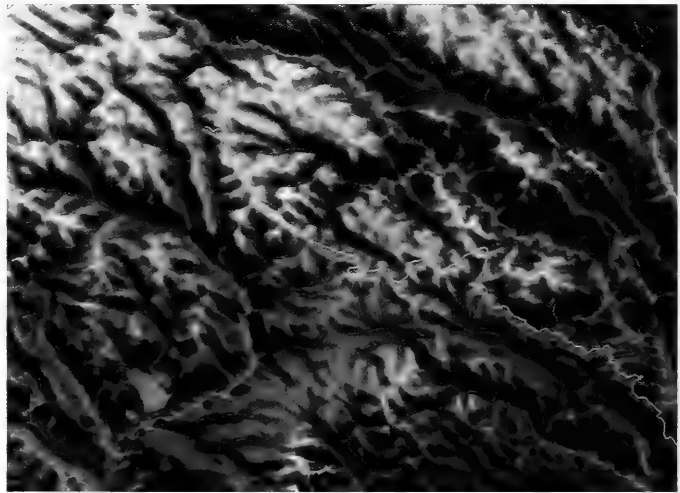


FIGURE 12. Close-up perspective view of the northernmost Gaoligong Shan (GLGS) looking from the west looking northeast, note the valley of the Luhit-Sang Qu incising into the GLGS and forming a near connection of the Luhit-Sang Qu-Parlung Zangbo and Nujiang drainages. Main ridgeline shown as a yellow line.

rocks. To the east of the ridge is the Gaoligong Shan Fault, which forms the bed of the Nujiang River (see Fig. 4). The action of the fault causes enough brecciation and mylenation of the country rock to enable the river to carve a gorge that is thousands of meters deep and form a non-glacial “U-Shaped” valley. The eastern side of the Nujiang River is the Qintang Terrane composed of primarily younger rock. It also has a large fault structure river complex along the course of the Lancang River (see Figs. 3–4).

The non-glacial “U-Shaped” valley of the Nujiang River is

formed by uplift. The land is currently being uplifted more in the west. This forces the river towards its east bank and hence undercuts it, thus, widening the valley floor. On the western bank in many places can be seen a bench that forms about halfway down from the ridge (personal observation, but it also can be seen on the elevation models; this bench is just visible in Fig. 15.). Most of the roads and towns of the Nujiang River valley are located on this bench and on the western bank in general.

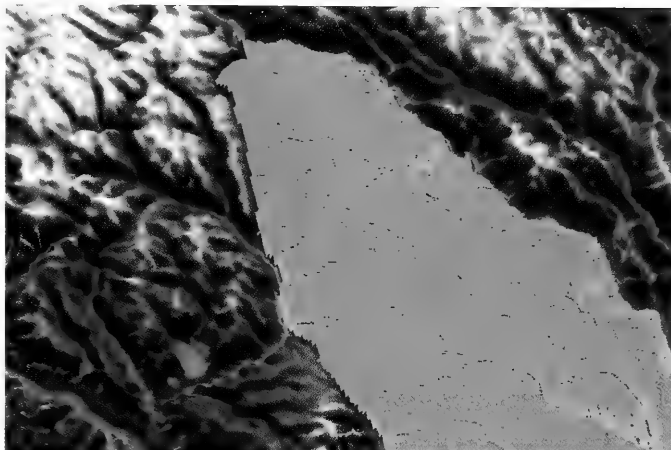


FIGURE 13. Close-up perspective view of the northernmost Gaoligong Shan, showing the area included in the GLGS in green. Main ridgeline shown as a yellow line.

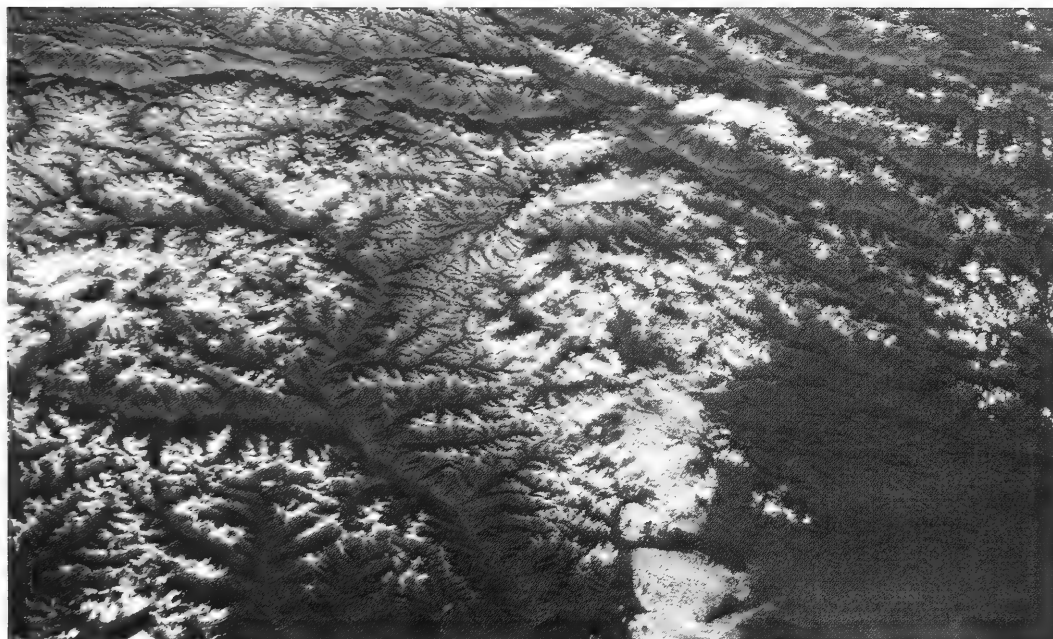


FIGURE 14. Space Imagery, taken looking ENE along the Luhit-Zayü and Sang Qu Rivers towards the Nujiang. Note the treeline at the headwaters of the Dulong in the south (right). Image courtesy of the Image Analysis Laboratory, NASA Johnson Space Center (NASA 2004c).

SHAPE OF THE MAIN GAOLIGONG SHAN RIDGE.—

The mountains of the GLGS and southern Hengduan Mountains in general rise from the south to reach impressive heights in the north. Just north of the GLGS across the Luhit-Zayü Qu-Sang-Qu drainage, is a large glacier field with peaks rising above 5000 m. This glacier is shrinking. The main GLGS ridge changes height from the 3001 m peak of Daxue Mountain Longling County at the southern terminus, down through a small saddle at 1930 m the lowest point of the ridgeline, to rise steadily upwards to 4500 m proceeding north as shown in Figures 19 and 20. The maximum height of any peak in the study area is 6318 m southeast of Zayü County. The course of the Nujiang River by comparison rises only 1500 m from 600 m in the south to around 2100 m towards the north of the study area. Therefore, the depth of the channel is much greater in the north than it is in the south. The valley is more than 3000 m deep at most points in the north and almost always more than 2000 m deep throughout the GLGS.

The GLGS ridge is traversed by only a few passes. In the south is the pass to Longling County that is the main route to the Myanmar border. Luoshuidong Pass, between Bawan and Tengchong Towns, provides another vehicle route to Myanmar. Pianma Pass is near Lushui Town. Other passes include the E'ga Path just north of Lukiu Town, the Yaping Path north of Fugong Town, and the Dazhu Path a little south of Gongshan town. A full vehicle road has been built through the high Dulong Pass in the north. Lastly, the Zayü County and Zogang County border road from Sichuan to Lhasa forms the northern limit of the GLGS.

CROSS-SECTIONS THROUGH THE GAOLIGONG SHAN.— The cross-sectional profiles of the GLGS area were taken from the low point at the easternmost edge of the study area in the west to the Nujiang River in the east. These profiles are remarkable for showing the steep walls of the peaks and deeply incised river valleys. The northernmost profile (Fig. 21) from the Zayü River to the Nujiang River shows uniformly high ground. The cross-section of Bingzhoulou Town,

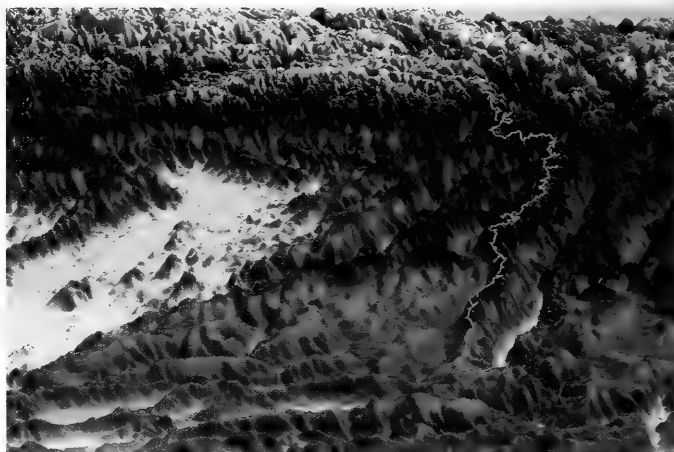


FIGURE 15. Perspective view from the southeast looking along the drainage of the Nujiang. Main ridgeline shown as a yellow line.

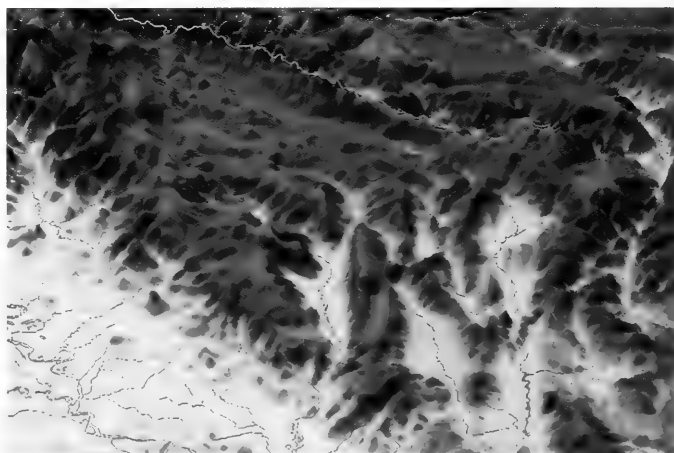


FIGURE 16. Close-up perspective view of the southernmost Gaoligong Shan. GLGS main ridgeline shown as a yellow line.

Gongshan County (Fig. 22) has some interesting features. To the east is the land that is lower in the upper Nmai-Irrawadi Rivers and generally lower across the eastern extreme of the Himalaya Block. The harder rocks of the tectonically deformed Lhasa Terrane stand very high. The Dulong River cuts a swathe through them almost as deep as that of the Nujiang River's valley on the other side of the main GLGS ridge. To cut this deep, there may be another fault active, although it is not shown on small-scale maps available. The Nujiang River runs in a very deep and steep valley at this point.

The next profile at Lukiu Town (Fig. 23) is across the area where the rocks are more uniform Paleozoic and form the "NE-SW Trending Ridges" that extend towards Jianga Mountain from the main ridgeline. The main GLGS ridge stands higher and there is little penetration of the rivers that here tend to run either north or south from the "NE-SW Trending Ridges". There is little in the way of river erosion in the mountains here because of their smaller catchment basins. Although the Nujiang River flows in a steeper valley than at its outlet, it is at an elevation little changed from its exit from the GLGS. The most southerly profile, through the top of Tengchong (Fig. 24), is from where the GLGS has been opened by N-S trenches along which flow the Longchuan River to the east and the Dayang River in the West. The southern profile is longer and lower than the rest and shows a series of peaks and

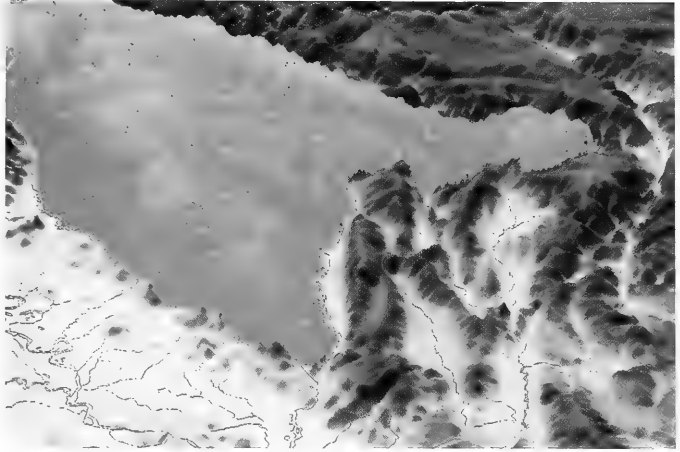


FIGURE 17. Close-up perspective view of the southernmost Gaoligong Shan, showing the study area included in the GLGS in green.



FIGURE 18. Space Imagery, taken looking east along the Longchuan River towards the Gaoligong Shan Ridge. Image courtesy of the Image Analysis Laboratory, NASA Johnson Space Center (NASA 2004b).

in the West. The southern profile is longer and lower than the rest and shows a series of peaks and

valleys where the tributaries of the Irrawadi River have cut into the Tengchong County region. These rivers also arise within the GLGS so have less volume or down-cutting potential. Uplift in this area is mostly lower than it is further north or it has been reduced by extension. The Nujiang River in the south is at about the same elevation as the Burmese Plain.

SLOPE AND SLOPE DIRECTION OR ASPECT.— What is unusual about the GLGS area profiles is that the deep valleys are cut into rocks able to support steep slopes. The average slope angle for the whole study area is high and is much higher in the north (see Fig. 25). There are very few flat areas of large size in the GLGS.

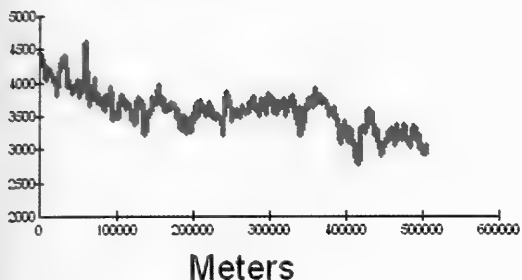
The N-S trending mountains of the main ridge of the GLGS together with the “NE-SW Trending Ridges” in the lower part both have unusual face aspects (see Table 1). Aspect is determined from the average direction that a slope faces relative to the sun. Throughout the study area, there is a paucity of north or south-facing slopes. The east-facing slopes are smaller than those to the west because they are steeper. There are many facing to the west and northwest and then again to the northeast and then east.

This fact, combined with the angle of the slope, means that many of the surfaces in the GLGS receive lower intensities of insolation relative to an ideal “suntrap.” Maximum insolation is received on a slope that is facing south and that is raised to the same azimuth as the sun; in the GLGS this is about 25 degrees. The low energy capture seen in the GLGS is because not much of the energy of the sun is trapped by the slopes that face away from the sun. When the sun shines on a surface that is steeply inclined and angled away from the sun, its energy is dissipated over a much larger area. The steep terrain will also affect the local sunrise, or sunset, or both, especially in a “U-shaped” valley. Therefore, the day length of direct sun, and hence the biotic productivity, will be much curtailed in the steep, “U-Shaped” valley bottoms. These factors produce temperate conditions, which prevail further south in the GLGS than in most places in the world. The magni-

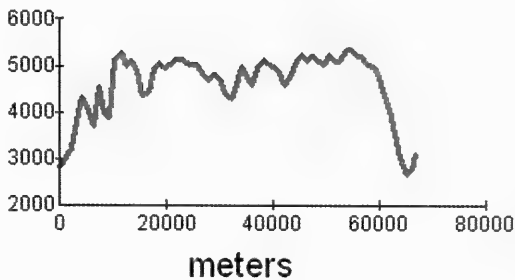


FIGURE 19. Plan of cross sections. See also accompanying figures 21 through 24

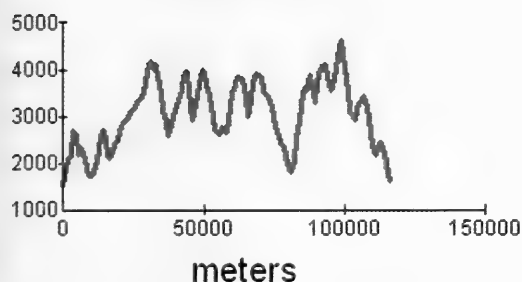
Ridge Profile



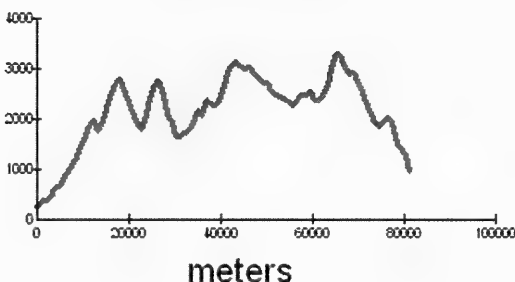
Zayu Profile



Bingzhongluo



Liuku Profile



Tengchong Profile

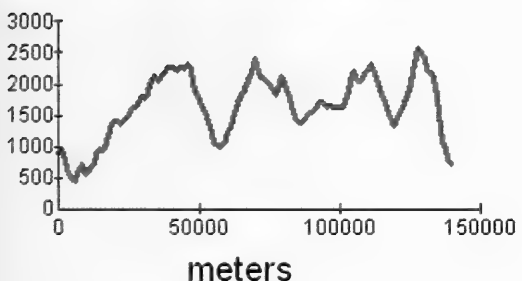


FIGURE 20. Profile of the main Ridgeline.

FIGURE 21. Cross section at Zayü.

FIGURE 22. Cross section at Bingzhongluo.

FIGURE 23. Cross section at Liuku.

FIGURE 24. Cross section at Tengchong.

tude of this effect can be calculated using advanced GIS analysis but this is too detailed to be carried out here.

LANDFORMS AND BIODIVERSITY.— The unusual physical features of the GLGS and their great latitudinal and elevational range provide for the easy maintenance of biodiversity. The north-south conduit enables exchange with the high mountains and plateau to the north. This provides a corridor for temperate animals to migrate southward during harsher conditions. The high elevation equally acts as a barrier for warm-adapted organisms seeking to migrate from west to east or vice versa. The deep, large rivers also act as barriers. The lack of south-facing slopes and the deep valleys combine to make the area relatively more temperate than land at similar latitudes. Cold

TABLE 1. Aspect faces of the GLCS.

<i>Aspect Direction</i>	<i>Plan Area %</i>
North	5.5
Northeast	13.0
East	15.5
Southeast	12.7
South	11.2
Southwest	13.5
West	16.8
Northwest	11.8

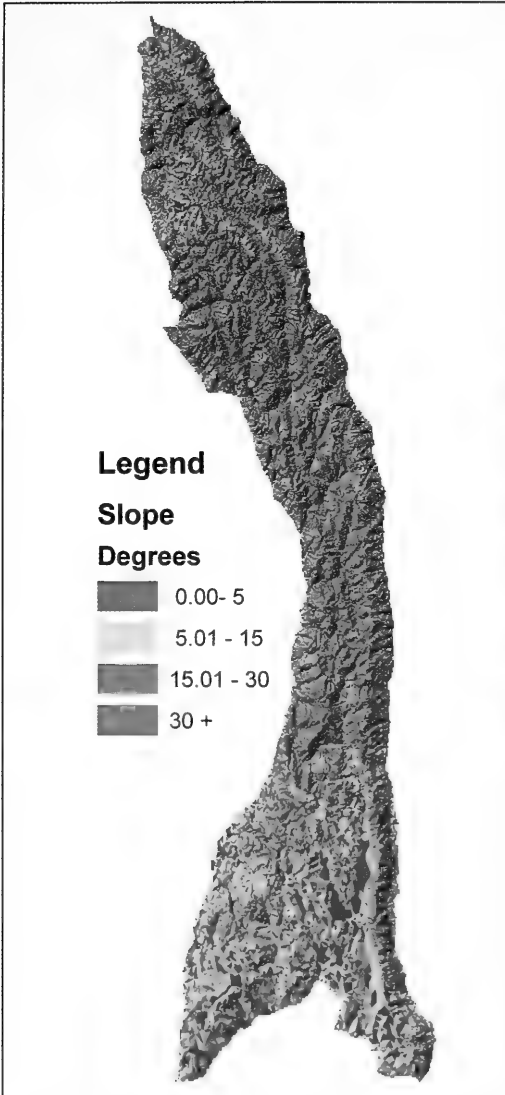


FIGURE 25. The plan view showing the Average Slope of the Gaoligong Shan.

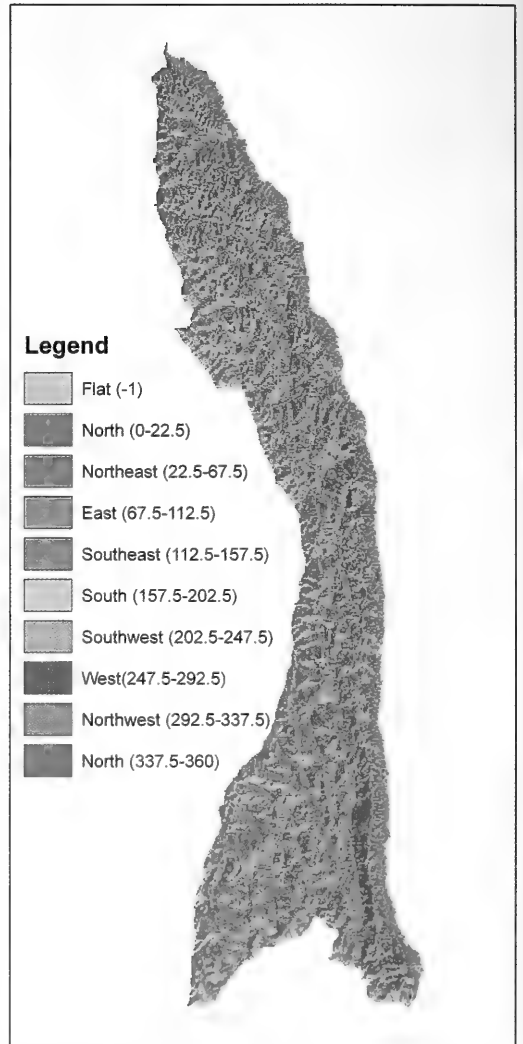


FIGURE 26. The plan view showing the Aspect of the Gaoligong Shan

air can flow into the valleys from high ground surrounding them. These “frost traps” lead to frequent fogs and temperature inversions. The high hills with damp air coming from the west have significant amounts of rainfall on their western slope. These conditions can lead to Foehn heating as damp air is forced over the ridge by the prevailing southwesterly winds. The unusual physical features combine to multiply the number of opportunities for microclimates. Furthermore, these physical features are not fixed in time but are dynamic due to the nature of the underlying geological processes. This dynamism provides ample opportunity for adaptation and vicariant events to further promote biological diversification.

HYDROLOGY

The large N-S flowing rivers of the Hengduan Mountains are of major importance to East and Southeast Asia. The rivers are long, stretching from the Tibetan Plateau to three different seas, the Yellow Sea, the South China Sea, and the Andaman Sea in the Bay of Bengal. Because of their length, each one of the rivers can have many names where they cross ethnic boundaries. These names will be given from north to south and in this paper they will be abbreviated to those shown in brackets, which are their names as used in the GLGS region. These are not necessarily the rivers' more widely used common English names. When using the abbreviated name the intention is for the reader to think of the whole drainage not just that portion in western Yunnan.

From east to west the main rivers are the Wulanmulunhe-Muluwusuhe-Tongtianhe-Jinsha-Cang Jiang-Yangtse River (Jinsha River), the Lancang-Mekong River (Lancang River) and the dNgul-chu-Naquehe-Nujiang-Thanlwin-Salween River (Nujiang River). An important tributary of the Nujiang River is the Nanding River, flowing just below the southern end of the GLGS. Starting in China and flowing into Myanmar are the south-southwesterly flowing tributaries of the Irrawadi. They are, from north to south, the Dulong-Taron River joins the Nmai Hka River (Dulong River), Dayang River, Wanding River and Longchuan-Shweli Rivers (Longchuan River). In the southern part of western Yunnan, just to the west of the GLGS, is the source of the Lishehe-Yuanjiang-Hong River (Red River) rising between the Lancang and Jinsha Rivers and its large tributary is the Black River. In the north are the Yarlung Zangbo-Brahmaputra River (Yarlung Zangbo River) and its two easternmost tributaries the Luhit-Zayü Qu-Sang Qu River (Sang Qu River) and the Yi'ong Zangbo River and Parlung Zangbo River. These form the northwest border of the GLGS. They flow to the Bay of Bengal in the west.

It must be strongly stressed that the drainage pattern around the Hengduan Mountains is com-

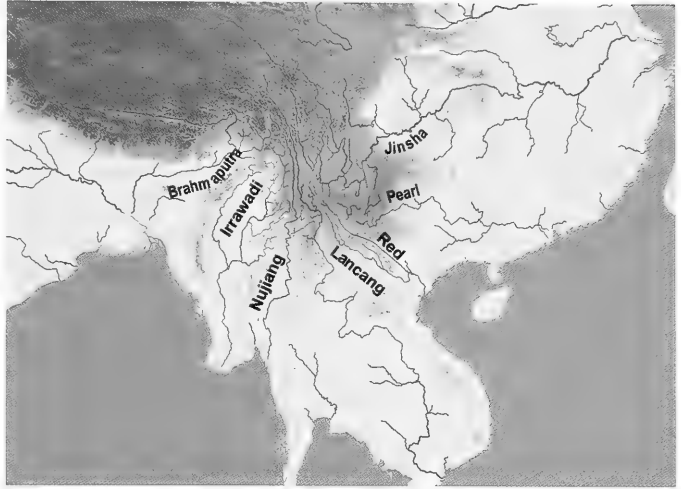


FIGURE 27. Drainage pattern of major rivers through the Hengduan Mountains emphasizing the interdigitated nature of the drainages. Data from Hydro1K (USGS 2000).

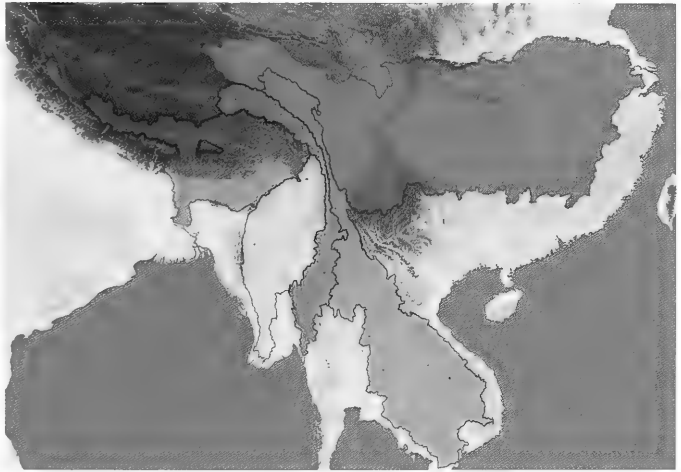


FIGURE 28. The modern drainage catchment basins data from Hydro 1K (USGS 2000).

plexly interleaved. This complicated pattern interdigitates to cause formidable barriers (see Fig. 27). To the north the Yarlung Zangbo River (Brahmaputra) and its easternmost tributaries form a natural barrier. The Yarlung Zangbo River (Brahmaputra) loops in a big bend from flowing east for hundreds of kilometers to turn south, then west, and on to flow southwest to the sea. This loop forms a major obstacle to migration or dispersal. Any migration from the west would be caught in this big bend and would have to back track or go north to get around it. From about the 10 Mya, the climate and ecology to the north would have been very different than that in the big bend area (Jablonski 1998). Today the barrier is complete as the ecology changes from humid tropical to temperate to alpine tundra within a few kilometers along the hills of Arunchal Pradesh. The Jinsha River makes a similar big bend in the opposite direction flowing to the south then east, and then north to turn eventually east again to the Pacific. Between these two, the Yarlung Zangbo (Brahmaputra) and Jinsha Rivers, the following Rivers, Lancang, Nujiang, the Dulong Nmai, and Irrawadi proper, all flow north-south. To the east, starting near the big bend of the Jinsha River is the source of the Red River and to the west of the Red River is its tributary the Black River that runs parallel to it. The Black River rises near to the Lancang River just east of the GLGS. Further east of the source of the Red River is the source of the Pearl River. These form NW-SE river drainages that cut off the approach to the Hengduan Mountains from southern China. The approach from due south to the GLGS (but not the Nushan Mountains) is cut off by the Lancang River and Nanding River and by the eastward flowing section of the Nujiang River. The approach to the Hengduan Mountains from the southwest is blocked by the Nujiang River and the Shweli-Longchuan River, Dayang River and other tributaries of the Irrawadi River. The approach from the west is blocked by the Yarlung Zangbo River (Brahmaputra), Irrawadi River, Tamai Nmai River, and the Dulong Nmai Rivers. West to east migration would be the most difficult because of the need to cross rivers and change elevation across the ridges of western Myanmar. The most isolated of the Hengduan Mountains ranges is the GLGS. The GLGS is highly isolated by its almost contiguous surrounding rivers.

The rivers of the Hengduan Mountains make them exceedingly good biological barriers to terrestrial organisms (Mackinnon et al. 1996). For many terrestrial organisms, migration into the GLGS or dispersion from them is very difficult. Forging the rivers is not easy because they run in very deep, precipitous valleys cut into the mountains. The ridges of the Yunling Mountains, Nushan Mountains, and the GLGS are steep, and traversing them requires agility and considerable environmental adaptability. The steepness of the riverbeds makes the current strong; some of the rivers have dangerous category five rapids. The rivers also carry high volumes of water and experience occasional catastrophic floods.

BIODIVERSITY IMPLICATIONS OF THE HYDROLOGY NETWORK.— It can be seen from Figure 28 that within the GLGS very little of the area belongs to the Nujiang River watershed. Most of the land area falls within the Irrawadi system. This can be inferred from the ridge profile as well. The Irrawadi is a much newer system than the Nujiang River because it does not drain north of the contact zone with India. A number of factors influence aquatic diversity, including age, temperature, and current.

In the past, these rivers would have been even more of a barrier than are today. The evidence strongly suggest that the larger rivers predate the closing of the Tethys Sea. The present rivers and the paleo-rivers drained regions as far north as the Kunlun Mountains an area north of the paleo-shore of the Tethys Sea. Before the formation of mountains, there was no rain shadow. The mountains rose in sequential thrust belts developing in the west of the GLGS as the Indian Plate impacted the Eurasian Plate. Therefore, the paleo-rivers would have had to drain the area that is now behind the Himalaya. The area to the north is now in the Himalayan rain shadow. The rain shadow

was absent throughout most of the history of these rivers. Therefore, they would have captured larger volumes of water than the impressive amounts they do today (see Fig. 28). The final uplift of the Himalaya to their current elevations has been in the last 7-3 million years of the 55 million years since India first contacted Eurasia. It was not until after this time that the rain shadow was extensive enough to cause aeolian erosion and loess started to be blown from the rising Tibetan Plateau. The main north-south flowing rivers divide the area biogeographically and socially. The antiquity of the rivers has insured that the areas divided by them accumulated considerable pre-Neogene diversity. Their large size and long length provide opportunity for aquatic diversity to evolve in multiple habitats. The changing levels in the rivers gave rise to fast currents and rough water, which have limited aquatic diversity and prevented migration and dispersal of endemics, while opening the possibility of local adaptation. Their encirclement of the GLGS has created one of the most isolated regions in the world, with a high number of endemic species. Another, biologically significant aspect of the large rivers is that they have provided unusually deep and secluded valleys, which have acted as refugia. Species can move up and down elevational gradients to maintain thermal equilibrium during periods of rapid temperature fluctuation. The unusual climates of the river valleys have promoted the successful survival of species extirpated elsewhere. The depth of the valleys effectively limits biotic productivity through reduced insolation relative to latitude and high humidity reduces light levels further. The rivers buffer extremes of temperature due to cloud and fog formation from high humidity. The river valleys allow warmer wind from the south to penetrate far to the north during the winter monsoon.

DEFINITION OF GAOLIGONG SHAN

Previous Definitions and Biogeography

The GLGS have been previously defined by several workers and environmental organization. Some definitions use the physical features to define the area. The best previous definition of the GLGS is that of Li: "The Gaoligong Shan is: the mountain range between Nujiang River and Irrawadi River, it is located in N 24°40'–28°30', covering totally 111,000 square kilometers, which includes the whole territory of Tengchong County, part but most of Longling, Baoshan, Lushui, Gongshan County area, besides N Burma area (Kachin State)" (Li 2000:vii). Although, this definition has a straight-line, latitudinal cutoff in the north and omits the SW ridge in Yingjiang County it covers most of the GLGS as it is defined in this paper. Lan and Dunbar define the Gaoligong Shan Region differently: "The region referred to as Gaoligong Shan here includes all lands west of the Salween (Nujiang) River in Yunnan. The entire region is situated at the southern edge of the eastern Himalayas, the westernmost region of Yunnan Province, and in the western part of the Trans-Himalayan Mountains" (Lan and Dunbar 2000:275–276). In practice, however, they used an essentially political definition; therefore, all of the land in Myanmar including the interconnected "NE-SW Trending Ridges" and the territory on the western side of the main GLGS main ridgeline in Lushui and Fugong Counties were excluded. Although politically this was not unreasonable, natural phenomena do not follow political constructions. The World Heritage listing definition of the Three Parallel River Region of Yunnan includes only the northern part of the GLGS ending at Lushui County at the end of the very highest ridgeline. It emphasizes the role of the gorges more than that of the mountains (UNESCO 2003). The GLGS are included in the recently revised and corrected definition of "Mountains of Southwest China, Biodiversity Hotspot" used by Conservation International (Conservation International 2005). However, it includes the whole Hengduan Mountains and Longmen Mountains and so is of little use in discussing just the GLGS.

Other workers defined the area according to biogeographical or ecological considerations. The Hengduan Mountains subalpine conifer forests zone (PA0509) used by the World Wide Fund for Nature (WWF) does not extend so far south or west as does the GLGS (Carpenter 2001a). The part of the GLGS region is included in Nujiang River Lancang Gorge Alpine Conifer and Mixed Forests (PA0516). "The Nujiang River Lancang Gorge ecoregion includes the valley system through which rivers flow down from the Tibetan Plateau into the tropical hills of northern Indochina" (Carpenter 2001b). This definition missed the western slopes of Myanmar that are in Northern Triangle subtropical forests (IM0140) (Than et al. 2001). The GLGS are spread between three different ecozones according to the WWF. Similarly, the GLGS are split by many other biogeographers and ecologists. Because of its elevation and latitude, the northern part of the GLGS is often classed as part of the Tibetan Plateau; the middle reaches with Yunnan Plateau; and the southern parts as subtropical forest continuous with that of Myanmar or Thailand (Mackinnon et al. 1996; Zhao 1986). The area of western Gongshan County and Fugong County is included in the Himalayan Southern Slope Region by Zhao (1986). Mackinnon (1996) includes most of the GLGS in the Palearctic Realm, Southwest China Province but makes a new subunit for the Nujiang River Lancang Gorges Area 39f, the middle of the GLGS is within sub-unit Yunnan Plateau 39a, whereas, the south is in the Indo-Malayan Realm, Tropical South China Province, sub-unit 10 the Thailand Subtropical Monsoon Forest (Mackinnon et al. 1996).

THE DEFINITION OF THE GLGS AS USED IN THIS PAPER

The name GLGS refers to mountain features, so it is best that it is defined by its physical geography. Therefore, the GLGS comprise the contiguous mountain ridges between the drainages of the Nujiang River (Salween River) and the Irrawadi River systems. In the north beyond the Irrawadi River headwaters the GLGS are between the Sang Qu River (Luhit), a tributary of the Yarlung Zangbo River (Brahmaputra) and the Nujiang River (Figs. 12–14).

The contiguous ridges were defined as land over 1800 m. The areas above 1800 m form interconnected ridges that join the Hengduan Mountains. This elevation was chosen as it is the cutoff of the "Monsoon Evergreen Broad-Leaves Forest" belonging to the *Castanopsis hystrix* and *Castanopsis echidnocalpa* forest type. This forest is distributed in moist ravines, on the east-facing slope in the southern part of the region, at elevations rising to but not above 1800 m (Li 2000). Using "Monsoon Evergreen Broad-Leaves Forest" for choosing the elevation for the ridges was helpful for two reasons. First, there are no barriers between "Monsoon Evergreen Broad-Leaves Forest" within the Gaoligong Shan and the same zone that spreads throughout a large area to the south and east covering broadly most of Myanmar and much of Southeast Asia. Second, above 1800 m the ridges are complete and continuous within the GLGS (Fig. 29).

In areas where there is neither a river barrier nor an extending ridge, the study area was curtailed at the 1000 m mark. This was necessary for only two small areas to the southwest of the "NE-SW Trending Ridges." Here the essentially flat area north of the Dayang River and south of the next tributary of the Irrawadi extend far into Myanmar before joining the Irrawadi. This area is also extensively farmed.

The Dayang River was followed as the boundary in the south until it turned to the north near Nansong Town. Then the boundary was cut across the top of Lianghe County from Nansong to Pingshan and the Longchuan River. The Longchuan River provides the boundary of the GLGS until it reaches the western slope of the GLGS ridge. Here the Longchuan River turns north along the border of Tengchong and Longling Counties. The final section of the GLGS southern border is encompassed by a line following the lowest contours round the end of the Mangshi River until it

reaches the first tributary of the Nujiang River the Supa River. The Supa River rises north of Zhen'an Village and runs from the northwest slope of Daxue Mountain on the GLGS ridge to travel west, before traveling south, southeast, and then eventually east to encircle the southern point of the GLGS main ridge. This definition provides the shortest route between the Nujiang River and Irrawadi drainages that encompasses the entire ridge complex.

As per the discussion of the GLGS above, the low ridges to the southwest of the GLGS, low ridges in Yingjiang Lianghe Counties and those in western Longling that extend into Luxi County could be argued to be also a part of the Gaoligong Shan. However, the decision not to include them was based on hypsographic arguments alone. The ridges are not contiguous but are separated by low points or watershed boundaries. These lower ridges all belong to the Irrawadi system not the Nujiang River drainage system. Therefore, they lie outside of the watershed between the Nujiang River and Irrawadi. The Nujaing-Irrawadi drainage boundary is at the Longchuan River, which forms the border between Longchuan, Lianghe, and Luxi Counties and this boundary is north of those County's southernmost ranges.

The Nujiang River and Irrawadi River Valleys provide the cutoff points to the Gaoligong Shan as these are the lowest points. The GLGS are defined as a hypsographic feature. On the opposite bank of these river drainages the slope must, by definition, rise again. Therefore, the contiguous slope runs only between the rivers.

The main observations about the physical features of the GLGS are presented in Table 2.

CONCLUSIONS AND IMPLICATIONS FOR BIODIVERSITY

The Hengduan Mountains are a haven of biodiversity. The GLGS are the most isolated of the ranges of the Hengduan Mountains, due in large part to the drainage pattern. The potential of the GLGS for preserving biodiversity, as well as causing it, may be unique in Eurasia. The position of the GLGS in Eurasia enables them to be a reservoir of biodiversity for all of East Asia.

The GLGS straddle the Indo-Malayan and the Palearctic biogeographic realms and have been split into different biogeographic provinces by different workers. The descriptions of these provinces have not caught up with modern understanding of tectonics, leading to considerable confusion. The physical geography of the GLGS is the result of tectonic activity. All of the plates form-

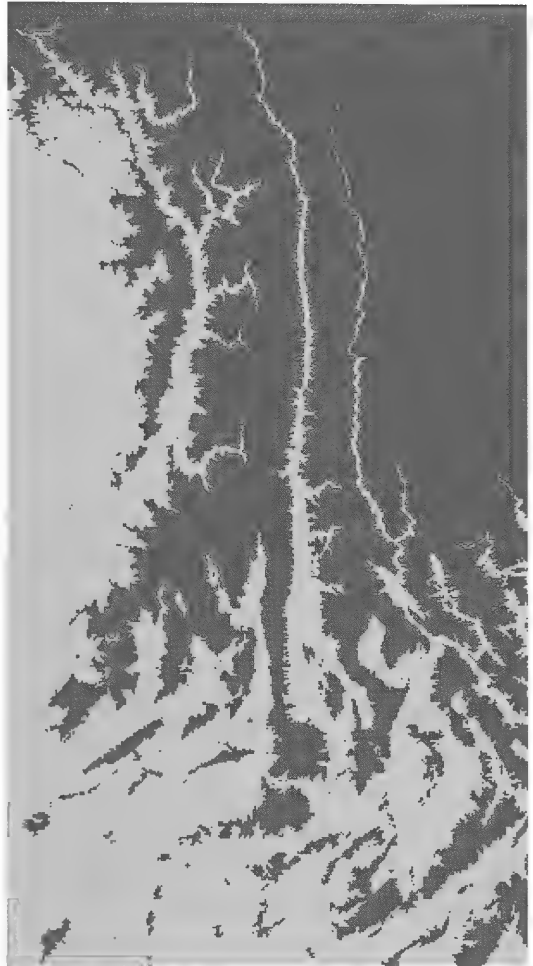


FIGURE 29. Map indicating all contiguous land over 1800 m in brown.

TABLE 2. General Facts about the Gaoligong Shan

1. Maximum Linear Length along Main Ridge 585 km.
2. Minimum Linear Length along NE-SW Ridge 565 km.
3. Maximum Width 150 km in the south near Tengchong.
4. Maximum Width 100 km in the north near Gongshan Town.
5. Minimum Width 48 km near Fugong Town.
6. Bounding Box 97.47°E, 29.51°N and 99.03°E, 24.37°N decimal degrees.
7. Maximum Elevation 6318 m southeast of Zayü County.
8. Minimum Elevation 183 m Drainage of the Nmai River in Myanmar.
9. Minimum Elevation 620 m Drainage of the Nujiang River.
10. Mean Elevation 2638 m.
11. 62% of the land lies between 1500–3500 m.
12. 11% of the land is above the approximate tree-line of 4500 m.
13. Only 7.8% of the surface area is essentially flat (slope < 3%).
14. Mean slope for the whole area including the drainages is 13.4%.

<i>Elevation Band</i>	<i>Surface Area In Plan View km²</i>	<i>3d Surface Area Along Slope km²</i>	<i>Area in Band 3d Surface km²</i>	<i>% of Total 3d Area in Band</i>
0–499	41937	44147	279	0.63
500–999	41661	43867	1642	3.72
1000–1499	40056	42226	4078	9.24
1500–1999	36114	38147	8395	19.02
2000–2499	28007	29753	8453	19.15
2500–2999	19951	21300	6040	13.68
3000–3499	14309	15260	4520	10.24
3500–3999	10133	10740	3491	7.91
4000–4499	6891	7249	3334	7.55
4500–4999	3763	3915	3112	7.05
5000–5499	778	803	798	1.81
5500–5999	4	5	5	0.01
<i>Total Area</i>	41937 km ²	44147 km ²		

ing the GLGS are from Gondwanaland, but some of them have been in contact with the Eurasian Plate (Palearctic Biogeographic Realm) for upwards of 200 million years. The Indo-Malayan region is physically an assembled unit composed of units of vastly different ages. For a review of current usage of China's zoogeographical zonation refer to Mackinnon et al. (1996).

Tectonic forces themselves create a genetic "melting pot" for biodiversity. The paleo-separation and subsequent re-aggregation of plates from Gondwana and the collision of plates from different paleo-continentals laid a foundation of high genetic diversity. This was accentuated by the region's long and complex uplift history. Slowly rising landmasses provided opportunities for adaptive changes in resident organisms. Geographic isolation due to the tectonically driven incision of the landmass by massive rivers has further enhanced biodiversity through vicariance.

Tectonic forces give rise to a diversity of host rock and soil types. This diversity has further enhanced the potential for increased biodiversity. The great range of host rocks, elevations lati-

tudes, and monsoon conditions within the GLGS has given rise to considerable soil diversity. This, in turn, gives rise to floristic diversity and heightened biodiversity at all higher trophic levels. Adaptive forces related to tectonics operate at both the macro as well as the micro landscape scale. The many preserved volcanic cones in the area of Tengchong resulting from tectonic melting, could be a source of local adaptation and vicariant speciation of smaller organisms as is known from other volcanic fields, e.g., *Drosophila* on Hawaii.

SUMMARY

摘要

高黎贡山是由不寻常的地质连锁成形运动构成的一个独特地区。同其它相近纬度的地区比较, 由于缺少南向坡面和具有较深的山谷, 它的气候更为温和。冷空气从周围的高地注入, 导致了多雾和气温倒位现象。从西面来的潮湿空气, 在高海拔山体的西面形成大量降雨。季风气候的形成改变了降雨模式, 以致大量降雨在短期之内于该地区倾降下来。沿山脊被挤压的焚风进一步改变了气候。透过减少和纬度相关的隔离, 山谷的深度限制了生物的生产能力。这一地区的河流的存在, 缓冲了由于潮湿而成的多云多雾导致的极端气温。上述所有不寻常的物理现象, 它们共同作用的结果增加了小气候形成的机会。

怒江和伊洛瓦底江的古老性, 河流规模和长度是形成淡水生生物多样性进化的可观因素。河流自身同时也是有机体不可逾越的迁移和散布屏障, 它将高黎贡山内部与周边区域隔离开来。河流从生物地理上分割了这个区域 (Jablonski and Pan 1988)。从而导致了高水平的特有性 (Mackinnon et al. 1996)。河流的屏障作用在于阻止散布, 并保护该地区不受外来物种的侵入而失去完整的特有性。高深河谷的另一作用是提供难得的深而隐蔽的气候避难所。物种能沿海拔高度倾斜而维持气温急剧波动期间的热量平衡。不寻常的河谷气候促成了那些在其它地区灭绝的物种能在该地成功存活。用当地居民的话来说就是: “这里一天之内四季分明”。

结论

高黎贡山的地貌来源于地球物理运动, 是多次发生于该地的气候变化结果。古地中海时代, 该地的气候既炎热又潮湿。季风形成后, 变为较为干燥和凉爽。自季风气候在早于七百万年前形成后, 许多发生于该地区的物种已经跨越了这个间隔, 适应了季节性的季风气候。孤立的高黎贡山自然环境可能提供了相对较低的捕食动物负荷。自然动力和地球物理作用本身为形成生物多样性替代物种的适应提供了广阔的空间。加深了诸如古气候变化、季风和冰区避难所形成, 而导致全球性的影响。这类全球性影响的方式已在横断山得到表达, 而在高黎贡山所不同的是, 它对低地与周围东西走向山地的影响。这个对地球作用的独特性增加了该地的生物多样性。高黎贡山以其数量繁多的孑遗、特有和替代种闻名。高黎贡山的独特性保证了其生物多样性的繁盛, 艰险的地形制约了当地的农业发展并进一步限制了高度的人类活动, 从而对其生物多样性具有保护作用。

ACKNOWLEDGEMENTS

Thanks for support to Environmental Systems Research Institute (ESRI) for supplying data and software to the California Academy of Sciences. Thanks also to Dr. Nina G. Jablonski for advice and help with editing and to Dr. Peter Fritsch and Dr. Bruce Bartholemew for comments on an earlier draft and to several anonymous reviewers whose comments led to a greatly improved presentation. Thanks also to Dr. Nina G. Jablonski for the invitation to visit the GLGS. Dr. Lihua Zhao, Department of Botany, California Academy of Sciences, prepared the Chinese versions of the conclusions and summary statements that accompany this paper. This publication represents Contribution No. 39 of the Center for Biodiversity Research and Information (CBRI) and Contribution No. 27 of the China Natural History Project, both at the California Academy of Sciences.

CARTOGRAPHY AND DATA.— Care was taken to ensure that political borders were depicted representatively; however, they are provided only for indicative purposes and do not represent any territorial claim or agreements. Representation of borders will depend on the dataset used and differs slightly between maps. The reader should note that the borders are disputed in a number of areas within the Hengduan Mountains region. No opinion is expressed or implied in the cartography or text. Place names are given to be as informative as possible to the general reader; they do not mean to imply any special meaning to the names used in this paper. Place names are taken from the Map of the People's Republic of China (Carto. Pub. Hse., 1984) and from common usage.

The data used in this paper came from a variety of sources. The following datasets were used either alone or in combination to produce the maps (ESRI 1996; F.A.O. 2005; Steinshouer et al. 1997; USGS 1993, 2000, 2004; Wandrey and Law 1997). All maps are original maps produced from the data using ArcGIS© and ArcView© (ESRI 1999, 2004).

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The Giant Pill-Millipedes of Madagascar
Revision of the Genus *Sphaeromimus*,
with a Review of the Morphological Terminology
(Diplopoda, Sphaerotheriida, Sphaerotheriidae)

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The Malagasy sphaerotheriid genus *Sphaeromimus* DeSaussure and Zehntner, 1902 is revised. Known heretofore from a single male specimen, the genus now contains three species, *Sphaeromimus musicus* (DeSaussure and Zehntner, 1897), *Sphaeromimus splendidus* sp. nov. and *Sphaeromimus inexpectatus* sp. nov. The female of *S. musicus* is described here for the first time. The mouthparts of giant pill millipedes were observed for the first time using scanning electron microscopy and species- and genus-level characters are illustrated. Intraspecific variation of the female stridulatory organ, the ‘washboard’ is described. For the first time in Malagasy Sphaerotheriida, some ecological comments are given. Characters found in the male telopods and the female stridulatory organ (the washboard) indicate that characters employed previously for the definition of subfamilies and tribes cannot be maintained and the monophyly of such groups remains questionable.

KEYWORDS: *Sphaeromimus*, Sphaerotheriida, giant pill-millipedes, Madagascar, Diplopoda.

Based on its species-richness and high level of endemism (Myers et al. 2000), Madagascar was recently listed among the eight eminent biodiversity hotspots of the world. Madagascar, as the fourth largest island of the world, harbors a diversity of different ecosystems, resembling in this regard a small continent. Due to its over 150 million years of isolation from the closest continental landmass Africa (Rabinowitz et al. 1983; Wells 2003), its flora and fauna are unique and very distinct from that of other regions of the world. Furthermore, the fauna and flora of Madagascar are extremely poorly known, as is the case for many species-rich regions outside northwestern Europe and North America. Ongoing faunistic research on the island of Madagascar continues to discover numerous new species, even among vertebrates (Jenkins 1993; Glaw and Vences 1994; Sparks and Stiassny 2003). Since the destruction of natural habitats is advancing on the island at an alarming rate, alpha-taxonomic research with regards to invertebrates is extremely urgent, as many species may vanish before ever being described. Three Malagasy ecosystems, the east coast littoral forest, highland vegetation and the western dry deciduous forests have shrunk by over 90% of their former distributions and belong now to the most threatened ecosystems of the world (Ganzhorn et al. 2001; de Gouvenain and Silander 2003; Vincelette et al. 2003).

The millipede genus *Sphaeromimus* revised below illustrates the understudied invertebrate diversity as well as the threatened status of its species. The diverse arthropod class Diplopoda is

one of the severely understudied animal groups. Over 9,000 species have been described so far (an exact species catalog does not yet exist) and estimates of millipede species richness are given as approximately 80,000 species worldwide (Hoffman 1980). As far as it is known, millipede species are often microendemic with very small distribution ranges; in some cases related species may occur just 20 km apart (Enghoff 1983; Hamer and Slotow 2002; Mesibov 1998). Despite the fact that most millipedes are macroinvertebrates (adult size from a few millimeters to 28 cm body length in *Archispirostreptus gigas* (Peters 1855)) and are of considerable ecological importance for litter breakdown within the decomposition cycle (Wolters and Ekschmitt 1997; Curry 1994; Crawford 1992; Schaefer 1990), biological research on the class suffers from lack of alpha-taxonomic attention, mainly due to the paucity of taxonomic experts for the group.

The Malagasy giant pill-millipede genus *Sphaeromimus* was heretofore known from a single male specimen of *Sphaeromimus musicus*. Among recently collected material by the senior author and from survey work by Goodman (Field Museum) and Griswold (California Academy of Sciences), female specimens of *S. musicus* and material of two new species of the genus were discovered. The four-jointed anterior telopods are the distinguishing feature of the genus. In *Zoosphaerium* Pocock, 1895, the other genus of giant pill-millipedes occurring in Madagascar, the anterior telopods have only three joints. Furthermore, features of the female vulva in *Sphaeromimus* do not agree with characters used by Jeekel (1974) in the most recent classification of the millipede order Sphaerotheriida and further phylogenetic analyses of the order will be required to clarify its internal classification.

The two newly discovered species of *Sphaeromimus* described below are each known only from small, isolated remnants of the southern littoral forest on Madagascar. This very limited distribution, the still ongoing anthropogenic influence in these remaining littoral forest patches and further possible disturbance of the habitat by mining projects may make these two new species likely to be among the most endangered millipede species of the world.

MATERIAL AND METHODS

The senior author (T.W.) collected specimens of the two new species described here during fieldwork in Madagascar in March and April 2003. Specimens of *S. musicus* were borrowed from the California Academy of Sciences (CAS) and the Field Museum (FMNH).

Specimens were euthanized using ethyl acetate, straightened and preserved in 70% ethanol. All measurements are in mm.

DISSECTIONS, ILLUSTRATIONS.— Dissections were made with a scalpel, in very small specimens with a dissecting pin. The following structures were dissected (a) the anterior and posterior pair of telopods, which were separated from each other using a needle; (b) the left leg of the 9th pair in males and females; (c) the 2nd leg pair in females; (d) the 1st leg pair with 1st sternite in females and males, (e) the subanal plate with 'washboard' in females; and (f) a section of the endotergum from a tergite in the center of the body, removed using scissors. Dissected specimen parts were cleared in clove oil. Drawings were done using a camera lucida mounted on a dissecting or compound microscope depending on size of specimen. Small specimens were held in position using clean sand at the bottom of dissecting dishes.

For scanning electron microscope examinations the following parts were dissected: (a) The right/left antennae were cut off with a scalpel near the insertion in the head. (b) The gnathochilarium was removed by cutting along its base with a scalpel and separating the tentorium with scissors. After removal of the gnathochilarium, (c) the mandibles were cut easily at the first joint with scissors and scalpel. (d) The epipharynx was separated from the head with a needle and then pulled

out with forceps. (e) The remaining head capsule was separated from the body using forceps. (f) The 2nd leg coxa of males was removed from the body.

SEM PREPARATIONS.— Specimens were dehydrated through a series of alcohol to 100% ethanol, mounted on stubs using sticky tabs and air-dried overnight. The 2nd leg coxa of the male with the gonopore was critical point-dried. Stubs were sputter-coated with gold and observed with an AMRAY 1810 SEM (Field Museum).

TERMS

As is true for many millipede groups, systematic treatments of the order Sphaerotheriida are scant and were done by a few authors, e.g., Verhoeff (1927, 1928, German) and Attems (1897, German), Silvestri (1917, Latin), Jeekel (1974, English) and recently by VandenSpiegel et al. (2003, English). Authors used terms in the various languages and the equivalency of such terms in the different treatments is sometimes difficult to determine. Since millipede morphology is less well known than that of other arthropod groups, which in the past have been explored more extensively with high quality light microscopy and scanning electron microscopy, the nomenclature of several morphological terms is currently neither standardized nor stabilized in the Diplopoda. For that reason we list terms used in this paper, along with terms used by other authors for apparently the same structure. Our use of such terms does not necessarily imply homology.

Anal shield.— Formed by the fused tergites of the last 3(?) diplosegments (= pygidium of authors, e.g., VandenSpiegel et al. 2003). In males of some sphaerotheriid species the anal shield is invaginated in the middle (Fig. 11H). Such invagination may play a role in mating behavior.

Antennae.— The first visible joint of the antennae, inserting in the antenna socket, is termed 1st antennomere.

Anterior paratergite depressions.— Denotes the anterior rim of the lateral extensions of the tergites (Paratergite, see below), a well circumscribed slightly concave area which glides under the posterior margin of the proximal tergite during volvation (Figs 1, 28–29, 50). Recent treatments on Sphaerotheriida did not explicitly discuss this morphologically distinct area.

Bursa.— Jeekel (1974) applied this term for the structures of the female vulva below the operculum. The ‘bursa’ consists of two sclerites, the exterior and inner plate (EP and IP) (Figs 5, 33, 55).

Endotergum.— The underside of the posterior margin of the tergites carries crenulations, spines and bristles, often in a species-specific arrangement (see VandenSpiegel et al. 2003; ‘Unterblatt’ *sensu* Verhoeff 1928: plate 10, fig. 123).

Gnathochilarium.— Since homologies with sclerites of helminthomorph gnathochilaria are unresolved (see Hoffman 1976:125), the sclerite terminology used here for sphaerotheriid gnathochilaria is descriptive. Usage of the term lamellae linguales below does not constitute a statement of homology.

Harp.— A set of ridges located on a discrete plate on the first joint of the anterior telopods of males (Figs 8, 37, 58).

Inner horns of posterior telopods.— Lobe-like projections attached mesally to the syncoxite, termed coxal horn by VandenSpiegel (2002), and ‘Hörner des Syncoxit’ by Verhoeff (1928:676). Indicated here by IH = inner horn. Also, see below under ‘Telopods’ (Figs 11, 35, 57).

Lamellae linguales.— Two longitudinal sclerites between the left and right paramentum of the gnathochilarium. In *Sphaeromimus*, the two sclerites are partly fused. At the distal tip of the lamellae linguales are pads carrying sensorial cones (Fig. 48). These pads were termed ‘Zäpfchenkappen’ by Verhoeff (1928:872). The homology of these two sclerites with the lamellae

linguales of the Helminthomorpha is questionable (see Hoffman 1976).

Male gonopore.— Opening of the vas deferentia on the posterior wall and the inside margin of the coxa of the 2nd leg pair (Fig. 27). Verhoeff (1928:695) stated that in Sphaerotheriida the male genital opening consists of a small, inconspicuous pore; other authors (e.g., VandenSpiegel et al. 2003) described somewhat more complex structures and denoted them with the terms penes and pseudopenes. DeSaussure and Zehntner (1897/1902) illustrated the male gonopore in several species and genera of the Sphaerotheriida showing different structural elements.

Molar plate process.— Elongated process attached to the upper side of the molar plate towards the roof of the head (Figs 18, 40), as it occurs in the millipede clade Pentazoniida (comprising the orders Glomerida, Glomeridesmida and Sphaerotheriida). This structure is very prominent in sphaerotheriids and can be found on illustrations of other pentazonid mandibles (e.g., in glomerids by Köhler and Alberti 1990, fig. 2-3; in sphaerotheriids by Silvestri 1917, fig. 2). No term has been coined for this structure.

Paratergite (Verhoeff 1928:385, German).— Lateral extensions of the tergites. The anterior paratergite depressions (see above) are located on the dorsal side of the anterior margin of the lateral extensions of the tergites (Figs 1, 28–29, 50). Verhoeff (1928:385) also used the term ‘Seitenlappen.’ These lateral tergite extensions were sometimes called paranota. Paranota is commonly used for the metazonite extensions in Polydesmida. Since the latter denotes a different anatomical part than the ‘Paratergite’ *sensu* Verhoeff in the Pentazonia, we prefer to call the structure lateral tergite extensions or paratergite.

Sensorial cones.— Myriapods feature a variety of sensorial structures, one of which are cones with a small pore on their tip. All such structures called sensorial cones in this paper have this particular anatomy. The distribution of such cones may reveal species- or genus-specific characters.

Subanal plate.— Hypoproct or ventral scale of authors, equipped with a stridulatory organ (washboard) in females of *Sphaeromimus*.

Telopods.— In the Pentazonia, males have two pairs of modified legs, the anterior and posterior telopods, at the end of their bodies. These telopods are involved in mating behavior and sperm transfer. It is commonly assumed that these are homologous to walking legs and thus the most proximal joint is called the coxite. In Sphaerotheriida, the coxites of each telopod pair are fused, forming a ‘syncoxite.’ The homology of the more distal joints with podomeres is uncertain. Here, the joints distal to the syncoxite are indicated by numbers 1–3 (posterior telopods) or 1–4 (anterior telopods) respectively. Some authors (Mauriès 2001) distinguish between the anterior and posterior telopod by using the terms ‘paratelopod’ (anterior telopod) and telopod (posterior telopod).

Thoracic shield (‘Brustschild’ *sensu* Verhoeff 1928:473).— Formed by the enlarged tergite of the 2nd body segment, the one following the collum. It features wide lateral lobes with a distal concave groove (‘Gruben des Brustschildes’ *sensu* Verhoeff 1928:473) and a conspicuously raised brim, involved in volvation (Verhoeff 1928:473).

Vulva.— The vulva consists of the bursa and the operculum. Many authors used the term ‘cyphopods’ for the female organs in millipedes.

Washboard.— A stridulatory apparatus termed washboard by Jeekel (1999) is located on the subanal plate (=Hypoproct or ventral scale) at the caudal end of the body of females (Figs 7, 34, 55).

ABBREVIATIONS

CAS	California Academy of Sciences, San Francisco, USA
FMNH	Field Museum of Natural History, Chicago, USA
MNHN	Muséum National d’Histoire Naturelle, Paris, France

12T	12 th tergite
AI	Anal shield invagination
AS	Anal shield
EP	Exterior plate of vulva
IH	Inner horns on syncoxite of posterior telopods.
IP	Inner plate of vulva
O	Operculum of vulva
PL	Pleurite
S	Sternite
TO	Tömösváry organ

RESULTS

Genus *Sphaeromimus* DeSaussure and Zehntner, 1902

Sphaeromimus DeSaussure and Zehntner, 1902.

Sphaeromimus, Attems 1942.— Jeekel 1971, 1974, 1999 — Enghoff 2003.

TYPE SPECIES.— *Sphaeropoes musicus* DeSaussure and Zehntner, 1897. Other species included: *Sphaeromimus splendidus* sp. nov., *Sphaeromimus inexpectatus* sp. nov.

The Malagasy sphaerotheriid genus *Sphaeromimus* was first described by DeSaussure and Zehntner (1902) in their important work on the Diplopoda of Madagascar. Originally, the genus contained a single species, *Sphaeromimus musicus* (DeSaussure and Zehntner, 1897, sub *Sphaeropoes*), known only from a single male. Consequently, only male sexual characters were given with descriptive details focusing on the telopods. The unusual features of the species prompted Jeekel (1999) to suggest that the then known *Sphaeromimus* specimen may have been “mislabelled or [represents] an introduced Indian sphaerotheriid”. With the collection of male and female specimens of *S. musicus* at three different localities and the discovery of two new *Sphaeromimus* species, described below, it is now demonstrated that *Sphaeromimus* forms an established part of the endemic Malagasy fauna. Since the genus is no longer monotypic, genus-specific characters can be given.

The genus *Sphaeromimus* can be distinguished from the only other Malagasy sphaerotheriid genus *Zoosphaerium* Pocock, 1895, on the basis of numerous characters. The genus description given below includes the characters DeSaussure and Zehntner (1902) mentioned in the original description of the genus.

DIAGNOSIS.— Members of the genus *Sphaeromimus* can be distinguished from *Zoosphaerium* by the following combination of characters: antennae short, with six joints, antennomeres without small spines and first antennomere without indentation. Apical antennomere rounded with numerous (up to 77) sensorial cones (apical antennomere cylindrical with four or more sensorial cones in *Zoosphaerium*), number of cones species-specific. Tarsi in *Sphaeromimus* broad (2.5–3 times longer than broad, *Zoosphaerium* up to 4.5 times longer than broad), tarsal tip densely covered with ventral spines. Anterior telopods with four joints (*Zoosphaerium* with three joints). Males with numerous strong stridulatory ridges on a plate termed ‘harp’ located on the first joint of the anterior telopods. Females with prominent, long stridulatory ridges on the subanal plate called ‘washboard.’ Washboard divided into two parts by a suture of variable length depending on species. Cyphopod sclerites in the bursa of *Sphaeromimus* of unique shape. In *Sphaeromimus*, operculum of vulvae much longer than the 2nd leg coxa, without a central depression (operculum subreniform in *Zoosphaerium*). This high number of characters allows easy differentiation between the two Malagasy sphaerotheriid genera.

DESCRIPTION.— Known members of the genus range from 15 to 35 in body length, thoracic shield width ranges from 6.8 to 17.6.

Head: only antennae with genus-specific characters, remaining features of head agree well with those found in most other sphaerotheriids. Eyes with numerous greenish ocelli, two of which are larger and one ocellus laterally displaced and separated (Figs. 24–25). Clypeus with single tooth (called labrum tooth by other authors), surrounded by hairs set in small pits. Tömösváry organ developed as a small round pit as in all known members of the order (Fig. 25). Center of posterior edge of head with or without patch of very small bristles (Figs 14, 39).

Antennae: antennae short, six visible antennomeres more or less short and rounded. First antennomere without spines, 6th antennomere prominent, big, flat and longer than the others, carrying many (40–77) sensorial cones (Figs 20, 43, 61).

Mouth parts: external tooth of mandible with a distinct ‘step’ (Figs 18, 40), with 6 or 7 pectinate lamellae, apical teeth of pectinate lamellae broad and short (Figs 19, 41), number of teeth declining from apical to proximal pectinate lamellae. Gnathochilarium more or less hairy, with a few sensorial cones lateral of the palpi (Figs. 15–16, 47, 49). Centrally located pads (=‘Zäpfchen-kappen’ *sensu* Verhoeff) on the anterior edge of the lamellae linguales with sensorial cones (Fig. 48). Tip of palpi with numerous sensorial cones distributed regularly around the tip. Epipharynx very similar in shape as known from other sphaerotheriid taxa (see Verhoeff 1928:841, fig. 419) (Fig. 45).

Thoracic shield: ridges on lateral lobes of thoracic shield absent. Anterior rim of lateral lobes broad, used in volvation.

Tergites: surface varies somewhat but mostly hairless and almost polished, except for the anterior paratergite depressions (see Material and Methods) which are more or less densely covered with hairs. Tergites always without a median keel. Tergites 3–12 each with a black carina ventrally on the anterior section of the tergites. Carinae apparently function as a locking device (Verhoeff 1928:479), fitting over the rim of the lateral extension of the thoracic shield (Figs. 1, 28–29, 50). Endotergum variable, species-specific crenulations, marginal ridge and bristle patterns, marginal bristles branched (Figs. 17, 23, 44, 62).

Sternite: first sternite with a sclerotized ledge along the anterior sternite lobe (Figs 4, 31, 53). Sternite lobe long, curved towards the legs, reaching the apical edge of coxa. Coxae and sternites without spines, but sternites three and beyond with a spine-like process which reaches about to the stigma opening of the anterior sternite.

Anal shield: shape of anal shield not variable within genus. Males of *S. musicus* with a small invagination as described in other sphaerotheriids (VandenSpiegel et al. 2003; Jeekel 1986). Anal shield sometimes with a few small isolated hairs and a patch of hairs in the corners towards the 12th tergite. Ventral side of anal shield with single black locking carina (=‘Verschlussleiste’ Verhoeff 1928:479) on each side, locking carina with a slight central constriction (Figs. 3, 30, 52).

Legs: remarkably short and broad, especially the tarsus, being only 2.5–3 times longer than broad. Tarsi of first two leg pairs with three to five ventral tarsal spines and a straight apical claw. Tarsi of leg pair 3–21 with 10–15 ventral spines on the apical part and a curved apical claw with one apical spine. Coxal lobes present, with small black triangular spines, variable in the genus. Femur with toothed ridge (Figs. 2, 26, 33, 51). Prefemur of last pair of legs basally with a small sclerotized knob on posterior side.

Female sexual characters: subanal plate with washboard, consisting of well-developed stridulation ridges. Stridulation ridges always very long, ending just in front of the anterior margin of the washboard. Washboard with distinct median longitudinal groove, posterior rim of washboard with a central invagination. Shape of vulva unique. Operculum rounded and very long, always longer

than the coxa and can reach about half of the length of the prefemur. Exterior and inner plates (EP, IP) below the operculum (termed bursa by Attems 1928; Jeekel 1974). Cyphopod sclerites consisting of two triangular apical sclerites and a much larger smoothly rounded third sclerite, all visible as dark structures near the suture of the vulva between inner and exterior plate (Figs. 5, 32).

Male sexual characters: male gonopore conspicuous, located slightly above the middle and near the inside margin of the coxa of second pair of legs. Gonopores apparently complex, partially closed by a round sclerotized plate carrying a few long hairs and featuring at least two membranous folds (Figs. 6, 27). *Anterior telopods:* with four joints in addition to the syncoxite. Harp on plate of first joint with three or more prominent stridulation ridges (Figs 8, 37, 58). Posterior side of second joint always with a large immovable lobe-like flat projection. Lobe-like projection with some crenulation on the border juxtaposed the third and fourth joints. Fourth joint much thinner and longer than the proximal joints, about as long as the second and third joint combined. Apically with a single long sclerotized spine (spine A) on posterior surface, basally with two non-sclerotized spines (spines B). Spination sometimes variable within individuals, especially on the fourth joint. Distally with fringe of thick, long hairs (Figs. 9, 10, 38, 59). *Posterior telopods:* Syncoxite mesally with lobe-like projections, termed inner horns (IH). Tips of inner horns (IH) with apical thorn and patch of hairs; terminal portion of inner horn bent posteriorly more than 90°. Subanal lobe densely covered with hairs (Figs. 11, 56). The 2nd joint forms an immovable finger, the third joint forms a movable finger. Three characteristic non-sclerotized spines on the inside of immovable finger, spaced at 1/5 intervals. Small triangular non-sclerotized lobe next to most proximal spine. Stout tip of immovable finger hook-shaped. Posterior face of movable finger with several sclerotized ridges.

VARIATION.—Members of *Sphaeromimus* are small in comparison to *Zoosphaerium*, the latter can reach a length of 100 mm (e.g., *Z. hippocastanum*), but moderate in size when compared to others in the order Sphaerotheriida. The number of stridulation ridges on the female washboard is correlated with the length of the individual, with three ridges on each side in the smallest females of *Sphaeromimus splendidus* sp. nov. and up to five ridges in the largest females. The number of ridges on each side of the washboard may vary in the same specimen.

NATURAL HISTORY, BEHAVIOR.—Life observations of the two newly described species revealed that the first pair of legs is not used when walking on flat ground. The first pair of legs is held up, above the ground and next to the head. Upon encountering an obstacle such as a leaf or twig (personal observations, senior author), the first pair of legs touches the obstacle. The first leg differs morphologically from the remaining legs by having fewer ventral spines and lacking the typical apical spine. The 3rd–21st leg pair show identical characters with little variation, even in the same leg pair, regarding to the number of ventral spines and length of the claw.

Living animals of *S. splendidus* sp. nov. and *S. inexpectatus* sp. nov. seem to avoid climbing on steeply inclined twigs. When lightly touched while on branches the animals quickly roll up and drop down. Haacker and Fuchs (1972) reported a different behavior from apparently arboreal species observed in South Africa: when touched while sitting on a branch, the animals coil up the head and anterior body, but hold on firmly to the branch using the posterior legs. Only after repeated and aggravated disturbance the animals roll up and drop from the branch. One of the authors (T.W.) observed identical behavior as described by Haacker and Fuchs (1972) in one *Zoosphaerium* species found in Sainte Luce and Mandena, where they co-occur with the *Sphaeromimus*-species. This *Zoosphaerium* species was sometimes also found up to 250 cm high on trees and shrubs, feeding on the trunk. The behavioral differences may indicate different ecological niches for these sympatric sphaerotheriid species.

DISCUSSION.—Currently, too few specimens are known to evaluate sexual dimorphism with

regards to the number of sensorial cones on the antennae as is known to occur in other sphaerotheriid genera (Verhoeff 1928: 791). Regenerated antennae were observed in some specimens. In these, the number of sensorial cones was reduced.

The black locking carinae on the inside of the anal shield show a central invagination in some specimens, which may indicate a fusion of originally two separate carinae. Verhoeff hypothesized that the anal shield of sphaerotheriids results from a fusion of at least two segments, the 13th segment and the telson (Verhoeff 1928:448, Bitelotergit). The characteristics of the carinae described here represent further support for this notion.

Species-specific characters found on the endotergum have also been reported from the South African genus *Sphaerotherium* (VandenSpiegel et al. 2003).

The distribution of the here observed toothed ridge on the femora of all walking legs within the order is currently unknown, it may have been overlooked by other authors (Silvestri 1917: figs. 5-10 and 17, Jeekel 1986, fig. 4). This ridge is present in all Malagasy sphaerotheriids examined to date by the senior author. Because of the rarity of female specimens, the vulvae were not dissected. Thus, the exact form of the cyphopod sclerites cannot be illustrated here.

The movable finger of the chela of the posterior telopods carries sclerotized ridges on its posterior surface. DeSaussure and Zehntner (1902) suggested these to represent another stridulation organ (Figs. 11-12, 35-36, 56-57). Haacker (1969:455) and VandenSpiegel et al. (2003) describe a similar feature in the South African *Sphaerotherium* and suggest that it may provide a better grip on the female legs during mating and we agree with this suggestion. The lobe-like projection on the 2nd joint of the anterior telopods with its small crenulations may serve a similar purpose. The function of the inner horns of the syncoxite of the posterior telopods is uncertain. It can be suggested that the big spine on the inner horn of the syncoxite is used to open the female vulvae or to transfer the sperm, while the posterior and anterior telopods hold the female. Unfortunately, matings have been reported for only one sphaerotheriid species (Haacker 1968, 1969, 1974) who mentioned transfer of a spermatophore with the male legs. His observations appeared to indicate that females take the spermatophore into their mouths shortly after transfer of the spemathophor. However, dissections of the entire male and female head and SEM studies of the mouth parts revealed no special structure in the male mouth parts for sperm transfer and no visible sperm bag in the female's head.

CONSERVATION.— The two new species were found in two of the four remaining small patches of the southern littoral rainforest, in Mandena (1,103 ha, 160 ha slated as conservation area) and Sainte Luce (1,947 ha; Ramanamanjato et al. 2002, Vincelette et al. 2003). More field collecting in other areas may reveal other species of this interesting genus. Considering the fast destruction of the last isolated remaining forest patches (e.g., Green and Sussman 1990) and the endemism of the here described new *Sphaeromimus* species in Madagascar, new studies in other areas of the island are urgently needed.

Sphaeromimus musicus (DeSaussure and Zehntner, 1897)

Figs 1 – 27

Sphaeropoews musicus DeSaussure and Zehntner, 1897 (publication of figure).

Sphaeromimus musicus, Saussure and Zehntner 1902 (publication of description).— Jeekel 1999 (lists species name) — Enghoff 2003 (lists species name).

MATERIAL EXAMINED.— **TYPE MATERIAL:** Male holotype; Madagascar, Province: unknown, coll. A. Grandidier, MNHN, CH038, vidi, without telopods, specimen figured in atlas published 1897, plate 4, figure 1 a-e. **NON-TYPE MATERIAL:** 16 males, 3 females. Madagascar, Province: Toliara, coll. RNI Andohahela, par-

cel II, camp 6, ~120m NN, 24°49.0'S 46°36.6'E, 7-15.XII.1995, leg. S. Goodman, 2 males, 1 female; FMNH 5378. 2 males; FMNH 5372. 1 male; FMNH 5409. 1 male, pitfall trap 16-18; FMNH 5407. Province: Toliara, 1 male coll. Foret Analavelona, mid altitude forest with western and eastern elements, ~1050m NN, 9-15.III.1998, 22°40.7'S 44°11.5'E, leg. S. Goodman, 1 male; FMNH 5439. 2 males; FMNH 5427. Province: Toliara, coll. RP Berenty, Foret Bealoka, Mandrare River, gallery forest; ~35m NN, 24°57'25"S 46°16'17"E; 3-8.II.2002, leg. B.L. Fisher et al., 5 males; 2 females, BLF 5315; CAS. 2 males, BLF 5314; CAS.

DIAGNOSIS.—*Sphaeromimus musicus* can be most easily distinguished from any other Malagasy sphaerotheriid by its unique coloration and pattern (Fig. 13), which identifies the species unambiguously. The body is orange, with an irregular black pattern near the posterior margin of each tergite. Each of the paratergites wears a median distinct thick black stripe. *S. musicus* is markedly more hairy than the other species of the genus, with hairs covering the head, legs, gnathochilarium, sternites and anal shield (Figs. 1–2, 4, 14–15). The anterior paratergite depressions carry an elongated patch of hairs on each. The body is less highly arched than in *S. splendidus* sp. nov. The coxal lobes of the walking legs are only weakly developed, but somewhat bigger than in *S. inexpectatus* sp. nov. (Fig. 2). Remarkable is also the high number of over 75 sensu- al cones (Fig. 21) on the last antennomere, which is much higher than those of *S. splendidus* sp. nov. (Fig. 43). The female washboard (Fig. 7) and the male harp (Fig. 8) are the biggest known in all Malagasy sphaerotheriids, with the highest number of stridulation ridges in the genus *Sphaeromimus*. The shape of the female operculum is unique and shorter in *S. musicus* than in the other species of the genus. Its mesal margin is more strongly developed than in its congeners (Fig. 5). The lower part of the inner plate (IP) of the female vulvae is not sclerotized and carries some triangular black spines. Molar plate process of the mandible with a single step (Fig. 17). In *S. musicus*, the endotergum features a distinct band of flattened nodules between the marginal bristles and the internal area covered with short spines and hairs (Fig. 17).

DESCRIPTION.— Body length: 17.2–34.5; width of thoracic shield: 13.3–17.6; height of thoracic shield 7.5–10.1.

Habitus: In general, the tergites of this species seem to be higher than in most other Sphaerotheriida, with the exception of *Sphaeromimus splendidus* sp. nov.

Coloration: body orange, with irregular black pattern near the posterior margin of each tergite. Each paratergite with a distinct thick black stripe, thoracic shield with even thicker black stripe, collum mostly black. Anal shield almost completely black (Fig. 13); head, antennae and legs orange-red. In alcohol, pattern and coloration, especially orange and red, are lost over time, either through exposure to light and/or alcohol; black stripe may fade completely, the black pattern becomes very irregular. The illustrated specimen in the original description shows this loss of coloration clearly. For this study, we examined a number of specimens in different stages of coloration and pattern loss, from specimens featuring almost lifelike color and pattern to the stage illustrated by DeSaussure and Zehntner (1897).

Head: with numerous hairs and setiferous pits mostly around the clypeus and lateral of the eyes. Some long, isolated hairs around the eyes and more distributed over the rest of the head. Posterior margin of the head towards the collum with dense field of very small hairs (Fig. 14).

Antennae: shape as given in genus description. Length of antennomeres: 1>2>3=4=5<6; 6th antennomere being broadest and longest (Fig. 20), flat, reaching broadest point near the middle and does not taper towards the sensual plate, with up to over 75 sensual cones (Fig. 21).

Mouth parts: mandible with six pectinate lamellae; number of teeth of pectinate lamellae declining from apical to proximal (Fig. 19). Molar plate process with a sharp single step near the apical border (Fig. 18). *Gnathochilarium* ventrally with many hairs on the lamellae linguales. Field of four sensorial cones, three grouped together, the fourth displaced towards posterior margin,

located laterally of the palpi (Fig. 16). *Epipharynx* as in the genus description.

Collum: anterior margin with two rows of isolated long hairs, posterior margin only with few isolated hairs, rows of hairs of the endotergum visible.

Thoracic shield: with an area of numerous thick hairs on the concave lateral extension ('Brustschildgruben' *sensu* Verhoeff) towards the marginal rim. Anterior rim of the lateral extensions broad (Fig. 1).

Tergites: posterior margins of tergites three to seven with a visible fringe of short hairs, which originates from the endotergum. The anterior paratergite depressions of the tergites four to ten are densely covered with hairs, anterior paratergite depressions of the anterior tergites with several ridges each. Anterior paratergite depressions of tergites 11 and 12 also with pads of dense hair, but ridges not visible in intact specimens. Tips of posterior margins of paratergites project posteriorly. The endotergum features a distinct band of flattened nodules between the marginal ridge and the internal area covered with short spines and hairs (Fig. 17). *1st Sternite*: lobe long, reaching beyond the length of the coxa, covered with many long hairs and curved towards the leg pair (Fig. 4). The upper margin is smoothly rounded and completely covered with individual long hairs, lower margin hairless (Fig. 4).

Anal shield: rounded, neither bell-shaped nor tapered, in males there is a weak invagination not seen in females and less distinct than in the South African genus *Sphaerotherium* (Fig. 1:AI). The anal shield carries on both sides a black locking carina, sloping towards the posterior end of the anal shield (Fig. 3). The locking carinae in this species are well-developed, but narrow and of medium length compared to other species.

Legs: tarsi of leg pair one and two with only four ventral spines and only weakly curved claws. Claws of the tarsi of following legs are curved wearing 12–14 ventral spines. Ninth pair of legs with a small lateral lobe and many small black triangular spines (Fig. 2). Coxae of all legs at the inside margin densely covered with many long hairs, also on the following leg joints at the inside margin some very long, isolated hairs.

Female sexual characters: second pair of legs with coxal lobe. Operculum (Fig. 5:O) of vulvae very broad and long, reaching $\frac{1}{3}$ of the prefemur length. Mesal section of operculum drawn out apically and longer than lateral section. Center of operculum without indentation (=not subreniform), lower margin straight. Exterior plate (Fig. 5:EP) of vulvae long and broad, its anterior margin reaches around the base of the operculum. Inner plate (Fig. 5:IP) not as long as exterior plate, anterior margin of former ends below base of operculum. Posterior margin of inner plate not sclerotized, sloping lower than exterior plate, with short, triangular black spines (Fig. 5).

Subanal plate rounded, center of anterior margin with a broad shallow invagination. The washboard with six strong, symmetrical stridulation ribs which end just in front of the anterior margin. Subanal plate divided by central suture not reaching anterior and posterior margins of subanal plate (Fig. 7).

Male sexual characters: second pair of legs with a pronounced coxal lobe (Fig. 6). Anal shield with a weak invagination (Fig. 1:AS). *Anterior telopods*: first joint with a large stridulation harp and 5 stridulation ridges (Fig. 8), posterior side of second joint with a lobe-like projection, which reaches the 4th joint (Fig. 9). On its inside face two long, thin non-sclerotized spines (Figs. 10:G–H). The outside face of the lobe carries a patch of very small (sensorial) hairs (Fig. 9:H). The third joint is short and slightly invaginated towards the lobe of the second joint. Near the invagination insert two short (E) and one longer thin non-sclerotized spine (F) (Figs. 9:E–F). The 4th joint carries basally a low knob (C) and a lateral non-sclerotized thin spine (D) (Figs. 9:C–D). The apical portion of the 2nd joint lobe is juxtaposed the low basal knob of the 4th joint (Figs. 9–10). *Posterior telopods*: telopod syncoxite densely covered with hairs. Outer surface of 2nd joint basal-

ly with hairs, apically hairless. Stout tip of immovable finger hook-shaped. Chela without species-specific characters, movable finger with genus-specific dentition and row of crenulated teeth. The opposite finger (2nd joint) features crenulations juxtaposed to the crenulated teeth of the movable finger. Base of movable finger laterally with some long hairs, more densely towards the outer margin, apical section with a few sensorial hairs (Fig. 22).

DISTRIBUTION AND ECOLOGY.— According to current collection records, *S. musicus* appears to be restricted to the southwestern region of Madagascar. To date, *S. musicus* is known from three localities, indicating a wider distribution range than some other sphaerotheriid species on Madagascar, e.g., *S. inexpectatus* sp. nov. and *S. splendidus* sp. nov. *Sphaeromimus musicus* was collected in gallery forests as well as in over 1,000 m elevation. It is remarkable that no specimens of this species were found in the spiny dry forest so widespread in its range, but the species appears to be restricted to semi-humid habitats such as gallery forests. The species was not found among other sphaerotheriid material, e.g., of the genus *Zoosphaerium*, collected in the eastern Hylaea areas or the western dry-deciduous forest. Collections took place during the wet season, December, February and the first half of March. Members of the genus *Zoosphaerium* were found at all three sites (Fig. 65) from which *S. musicus* were collected. No eggs were found in a dissected female collected during the wet season (Dec. 7–15, 1995 in RNI Andohahela, parcel II). It is unknown whether this species is active in the dry season.

CONSERVATION.— The currently fragmented distribution of *S. musicus* is most likely the result of the continuing destruction of the natural vegetation. Habitat protection is vital for the survival of highly endemic species such as the type species of the genus *Sphaeromimus*.

DISCUSSION.— Males and females in Sphaerotheriida molt after maturity (pers. obser.). Ontogenetic changes of characters described above have not been investigated to date, e.g., it is possible that the number of stridulation ridges increases with the age and size of the animal. This seems to be the case in females, the number of stridulation ridges on the male harp remain constant (Table 1). The small size of the vulva in this species is remarkable when compared to the relatively larger female vulvae in the much smaller females of *S. splendidus* sp. nov. and *S. inexpectatus* sp. nov.

TABLE 1. Variation in *S. musicus*. * indicates specimens used for drawings and SEM; m: male; f: female; TS w: width of thoracic shield; SR: number of stridulation ridges of harp in males and washboard in females on left/right body side.

Sex	TS w	SR	Location
m*	17,0	5/5	RNI Andohahela, parcel 2
m*	16,0	5/5	RNI Andohahela, parcel 2
f*	14,5	6/6	RNI Andohahela, parcel 2
m	17,4	5/5	RNI Andohahela, parcel 2
m	15,8	5/5	RNI Andohahela, parcel 2
m	17,0	5/5	RNI Andohahela, parcel 2
m	16,5	5/5	RNI Andohahela, parcel 2
m	15,9	5/5	Foret Analavelona
m	15,4	5/5	Foret Analavelona
m	15,6	5/5	Foret Analavelona
m	17,4	5/5	RP Berenty
m	16,7	5/5	RP Berenty
m	16,7	5/5	RP Berenty
m	16,7	5/5	RP Berenty
m	13,3	5/5	RP Berenty
f	16,2	8/8	RP Berenty
f	15,5	7/8	RP Berenty
m	17,6	5/5	RP Berenty
m	16,5	5/5	RP Berenty

***Sphaeromimus splendidus* sp. nov.**

Figs 28–49

MATERIAL EXAMINED.— TYPE MATERIAL: 1 female holotype; paratypes: 1 male; 3 females, 1 male immature, coll. Madagascar, Province: Toliara: Sainte Luce, littoral forest, 24°47'S 47°10'E; 08.IV.2003, leg. Wesener; FMNH 6702, 6703. 1 female (mature), identical collecting data; CAS. OTHER MATERIAL EXAMINED: 2 males (immature), 2 females (immature), coll. Madagascar, Province: Toliara: Sainte Luce, littoral forest;

24°47'S 47°10'E, 06.04.2003, leg. Wesener, 2 juvenile, (width of thoracic shield: 3.4 mm, 2.9 mm; body length 7.6 mm, 7.0 mm), same collection data; vouchers, deposited at the Université Antananarivo.

DIAGNOSIS — *S. splendidus* is distinguishable from other *Sphaeromimus* species by its completely black coloration and tergites with a satin sheen. This species is almost hairless, with only a few individual hairs on the anterior paratergite depressions and on the thoracic shield (Figs. 28–29). The body is more highly arched than in other *Sphaeromimus*-species. The coxal lobe is very long and well-developed which is one of the main characters by which this species can be distinguished from *S. musicus* and *S. inexpectatus* sp. nov. (Fig. 33). Remarkable is also the small number of only 20–45 antennal cones and the 6th antennomere (Fig. 43) is very slender. The male anterior telopods differ from the telopods in *S. musicus* by possessing a small pointed process on the anterior side of the first joint, reaching the 3rd joint. The operculum of the vulva reaches over the middle of the prefemur; its anterior margin is well rounded. The black locking carinae of the anal shield are shorter than in the other two species. The molar plate process of the mandible possesses one small and one big step (Fig. 40). The endotergum features only one row of marginal bristles and unique, rounded crenulations between the marginal ridge and the internal area, which is covered with short spines and hairs (Fig. 44).

DESCRIPTION.— Body length up to 23.6; width of thoracic shield: 8.2–11.8 (mature); height of thoracic shield up to 6.5.

Habitus: In general, the tergites of this species seem to be higher than in other Sphaerotheriida and higher than in all other species of this genus (Figs. 28–29).

Coloration: The body is shiny black. Smaller specimens are crème-white with only a black posterior margin at each tergite. As the animals grow the black margins on the tergites expand until the tergites are completely black. Head and collum brown, antennae olive-blackish, but antennomeres five and six remarkably lighter in color. Legs also olive-blackish, but apically lighter in color.

Head: with numerous hairs and setiferous pits mostly around the clypeus and lateral of the eyes. Few long, isolated hairs around the eyes and distributed over the rest of the head. Posterior margin of head towards the collum hairless (Fig. 39). Field of little crenulated teeth near the antennal socket with one small spine (Fig. 46).

Antennae: shape as given in genus description. Length of antennomeres: 1>2>3=4=5<6. Sixth antennomere being longest (Fig. 42), flat, reaching broadest point near the middle, but is not broader than other antennomeres. Tapering only slightly towards sensorial disc. Only 20 to 45 sensorial cones (Fig. 43).

Mouth parts: mandibular molar plate process with two steps near apical end (Fig. 40); with seven rows of pectinate lamellae, teeth short and broad; apical pectinate lamella with 18 teeth, number of teeth declining proximally (Fig. 41). *Gnathochilarium* ventrally with few hairs (Fig. 47), group of 4 sensorial cones located in a pit laterally of the palpi (Fig. 49). *Epipharynx* genus-like (Fig. 45).

Collum: anterior margin with some isolated long hairs, posterior margin only with few isolated hairs.

Thoracic shield: with only very few small hairs on the concave lateral extension of the thoracic shield towards the margin. Brim of anterior margin of lateral extension only slightly broader than remaining brim.

Tergites: hairless, shiny, only the anterior paratergite depressions and their anterior margins with very few short hairs. Anterior paratergite depressions of the anterior tergites with several ridges each. Anterior paratergite depressions of tergite 12 also with few hairs, but ridges not visible in intact specimens. Tips of posterior margins of paratergites project posteriorly, stronger in ter-

gites 9–11 (Figs. 28–29).

1st Sternite: lobe as long as coxa and curved to the leg pair. Upper margin smoothly rounded, isolated long hairs near the border. Rest of sternite hairless (Fig. 31: S = sternite).

Anal shield: rounded, neither bell-shaped nor tapered (Figs. 22–23). Anal shield with distinct, broad, but short black locking carinae on each side, sloping towards the posterior end (Fig. 30). Remarkable is a very small invagination at the middle of the carinae.

Legs: 9th leg pair with a pronounced coxal lobe and many small black triangular spines (Fig. 33). Tarsi of first two leg pairs with only three to four ventral spines and only weakly curved claws. Tarsi of following leg pairs curved, with 10–14 ventral spines and the apical spine. Coxae mesally with many dense long hairs; other podomeres with few, very long, isolated hairs.

Female sexual characters: second pair of legs with well-developed coxal lobe. Operculum (*O*) of vulvae: very broad and long, reaching over $\frac{1}{2}$ of prefemur length; reaches its maximum length in center. Anterior margin without indentation (=not subreniform), lower margin with invagination in center. Exterior plate (*EP*) of vulvae long and broad, its anterior margin ends below base of operculum. Inner plate (*IP*) not as long as exterior plate, anterior margin of former extends below base of operculum (Fig. 32: *O* = operculum, *IP* = inner plate, *EP* = exterior plate).

Subanal plate rounded, center of anterior margin with a very broad shallow invagination. Washboard with three to five strong, symmetrical stridulation ribs, ending just in front of anterior margin. Washboard divided by central suture reaching anterior and posterior margins of subanal plate (Fig. 34)

Male sexual characters: second pair of legs with coxal lobe. *Anterior telopods*: first joint with a small harp and three stridulation ridges (Fig. 37) and on its posterior side with a very small projection, reaching the third joint. Posterior side of 2nd joint with a lobe-like projection, reaching 4th joint (Fig. 38: A = big spine; B = two small spines). Third joint short, 4th as described in genus description (Figs. 37–38). *Posterior telopods*: telopod syncoxite nearly hairless. Chela without species-specific characters, movable finger with genus-specific dentition and row of crenulated teeth. Opposite finger (2nd joint) features crenulations juxtaposed the crenulated teeth of the movable finger. Base of movable finger laterally with some hairs. Stout tip of immovable finger hook-shaped (Figs. 35–36). Immature males with bud-shaped anlagen (primordia) in the place of telopods as in mature male.

DISTRIBUTION AND ECOLOGY.— Some females collected in the beginning of April were carrying up to eight eggs, suggesting that the breeding season was in progress. Assuming a single annual breeding season and collecting adult egg-carrying females and juveniles with 19 leg pairs at the same time suggest that the adults are at least 2 years of age.

So far this species of *Sphaeromimus* was collected only from a fragment of littoral rainforest on sand in Sainte Luce. This particular patch of littoral rainforest is virtually undisturbed and may represent the best preserved of all four still existing southern littoral forest patches (Dumetz 1999; Vincelette et al. 2003; deGouvenain and Silander 2003). Juveniles and adults could be found in thick (30–80 mm) leaf litter, containing mostly big leaves of trees. The leaf litter was wet and did contain also a large numbers of Spirostreptida, Isopoda, winged Blattodea, Diplura and Collembola. In this assemblage, the giant pill-millipedes were the biggest arthropods found. This species was found together with two species of the genus *Zoosphaerium* (description in progress) one of which occurs also in the littoral rainforest in Mandena and in the eastern lowland rainforest. The second *Zoosphaerium* species appears to be restricted to Sainte Luce. The forest patch of Mandena was intensively searched for 18 days without success for *S. splendidus* sp. nov. In addition, *S. splendidus* sp. nov. was not found in any other collection samples. These observations suggest that *S. splendidus* sp. nov. is endemic to the littoral forest patch of Sainte Luce. Also, with

regards to the isopod fauna and vegetation (Dumetz 1999), the littoral forests of Mandena and Sainte Luce, albeit separated by a distance of only 20 km, display distinct faunal and floral differences. Currently, both patches of littoral forests are separated by pseudosteppe with apparently little humus and soil arthropods (pers. observation). Maps showing forest distribution dating back to 1950 indicate that continuous forest vegetation disappeared before 1950. Lehtinen et al. stated 2003: "At present, the landscape at Mandena and Sainte Luce is a series of littoral rainforest fragments in a matrix of extremely degraded anthropogenic sand-scrub. This barren sand-scrub is the result of previous forest clearing, burning, and attempts at cattle grazing and is presumably a hostile environment for forest-dwelling organism (p. 1359)." Our studies are comparable with this suggestion: no pill millipedes or other soil arthropods were found in the sand-scrub, no humus layer is visible in the pseudosteppe. Actually, there are no geographic barriers between the Mandena's and Sainte Luce's littoral rainforest, such as rivers and hills, which in other cases often form borders of a millipede species ranges. The only difference between the two localities is the annual precipitation, with higher rainfall in Sainte Luce (Donque 1972).

CONSERVATION.— The forest at Sainte Luce is subject to human impact and wood removal as one of us (T.W.) observed. Protecting this unique and still relatively pristine littoral forest should receive highest priority.

DISCUSSION.— Coloration not suitable for field identification, since shiny black *Zoosphaerium* species occur sympatrically. The only male known also shows the juvenile coloration, but has fully developed telopods and thus is most likely sexually active.

***Sphaeromimus inexpectatus* sp. nov.**

Figs. 50–63.

TYPE MATERIAL.— 1 male holotype (width of thoracic shield: 7.3mm), 1 female paratype, in parts (width of thoracic shield: 6.8mm); Madagascar, Province: Toliara, Mandena; littoral forest; in leaf litter with small fruits. 24°57'15"S 046°39'22"E; IV.2003; leg. Wesener; FMNH 6701.

DIAGNOSIS.— Coloration unique in the genus, males of *S. inexpectatus* pink to red (Fig. 63). Species almost hairless, except for some isolated hairs on the anterior paratergite depressions and thoracic shield (Fig. 50). Sixth antennomere broader than in the other two *Sphaeromimus* species, with well over 70 antennal cones (Figs. 60–61).

Coxal lobes only weakly developed. Lobe-like projection at the 2nd joint of the anterior telopods protruding laterally and reaching the distal end of the 3rd joint (Fig. 58: F = one thin spine), a unique feature for this species. *Sphaeromimus inexpectatus* sp. nov. differs from *S. musicus* by the possession of a small process inserting on the anterior side of the first joint of the anterior telopods, extending to the 3rd joint. Very remarkable is the curved, hook-like end of the immovable finger of the posterior telopods (Figs. 56–57). The operculum of the vulva is large and extends

TABLE 2. Variation in *S. splendidus* sp. nov. * indicates specimens used for drawings and SEM; m = male; f = female; TS w: width of thoracic shield; SR: number of stridulation ridges of harp in males and washboard in females on left/right body side. * small, bud-shaped anlagen (primordia) of telopods present.

Sex	status	TS w	SR
m	mature	8,0 (4th segment!)	3/3
f (type)	mature	11,8	5/5
f	mature	11,2	5/5
f	mature	9,0	4/5
f	mature	8,4	4/5
f	mature	8,2	4/5
m	immature	5,1	*
m	immature	4,7	*
m	immature	3,1	*
f	immature	6,2	4/4
f	immature	5,1	3/3
?	juvenil	3,4	—
?	juvenil	2,9	—

over the middle of the prefemur. Its anterior margin is well rounded. The black locking carina of the anal shield is longer than in the other two species (Fig. 52: AS = anal shield; PL = pleurite). External tooth of the mandible with one big and a second small step. The endotergum features only one row of marginal bristles, which are separated by a wavy marginal ridge from the intermediate area covered with short spines and hairs (Fig. 62).

DESCRIPTION.— Body length: circa 15; width of thoracic shield: 6.8 (f)–7.3; height of thoracic shield up to 4.5.

Habitus: In general, the tergites of this species seem to be lower than in all other species of this genus.

Coloration: body of mature male pink, posterior margin of each tergite with thin black line; immature female crème-white to reddish, posterior margin of each tergite with a broad, brown line. Head and collum in male type pink, anterior paratergite depressions gray to reddish; antennae and legs remarkably silver-gray to yellow.

Head: with numerous hairs and setiferous pits mostly around the clypeus and lateral of the eyes. There are some long, isolated hairs around the eyes and more distributed over the rest of the head. The posterior margin of the head towards the collum is hairless.

Antennae: shape as given in genus description; length of antennomeres: $1 > 2 > 3 = 4 = 5 < 6$, last antennomere as long as antennomeres 4+5 combined; last Antennomere flat and very broad (Figs. 60–61).

Mouth parts: mandibular molar plate process with one big and a second smaller step near the apical tip; with seven pectinate lamellae, 20 teeth in apical pectinate lamella, number declining proximally.

Collum: anterior margin with some isolated long hairs, posterior margin only with few isolated hairs.

Thoracic shield: with only very few short hairs on the concave lateral extension of the thoracic shield towards the marginal rim. Rim around anterior margin only slightly broader than around the rest of the thoracic shield.

Tergites: hairless with very few short hairs in the anterior paratergite depressions and with some more longer hairs on the anterior margin. Tips of posterior margins of paratergites do not project posteriorly (Fig. 50).

1st Sternite: lobe as long as coxae, with some isolated long hairs, curved towards leg pair, upper margin irregularly rounded with two invaginations (Fig. 53: S = sternite), a few isolated long hairs near the margin. Rest of the sternite hairless.

Anal shield: rounded, neither bell-shaped nor tapered. Anal shield with black locking carinae on each side, sloping towards the posterior end of the anal shield (Fig. 52: AS = Anal shield; PL = pleurite). The locking carinae in this species are well-developed and broad, remarkably longer than those of the other *Sphaeromimus* species. Locking carinae with distinct but very small invagination at the center.

Legs: the first leg pair with only three, the 2nd with four to five ventral spines and only weakly curved claws. Claws of the following leg pairs are curved. Coxal lobe at 9th leg pair very weakly developed, with many small black triangular spines (Fig. 51). Tarsi of remaining legs with 12–15 ventral spines and one apical spine (damaged in specimen). Coxae at mesal margin with many dense long hairs, also on following podomeres some very long, isolated hairs.

Female sexual characters: 2nd pair of legs without coxal lobe but with one black spine. Operculum (*O*) of vulvae very broad and long, reaching $\frac{1}{2}$ of the prefemur length, maximum length in the center. Center of operculum rim without indentation (=not subreniform), lower margin with weak invagination in the center. Exterior plate (*EP*) of vulvae long and broad, its anterior margin

ends below the base of the operculum. Inner plate (IP) is not as long as exterior plate, anterior margin of former ends below base. (Fig. 54: O = operculum, EP = exterior plate, IP = inner plate)

Subanal plate rounded, center of anterior margin with a broad invagination. The washboard with three strong, symmetrical stridulation ribs, ending just in front of the anterior margin. 1st and 3rd ribs smaller than 2nd. Subanal plate divided by short median suture only in the center (Fig. 55).

Male sexual characters: 2nd pair of legs without a coxal lobe. *Anterior telopods:* 1st joint with small harp and three stridulation ridges (Fig. 58: F = one thin spine), posterior side of 1st joint with a small projection which reaches the 3rd joint. Lobe-like projection laterally on posterior side of 2nd joint reaching 4th joint (Figs. 58–59). 3rd joint short and slightly invaginated towards the lobe of the second joint, with one longer thin non-sclerotized spine (F) juxtaposed the second joint lobe (Figs. 58–59: A = big spine, B = two small spines, D = small lateral spine, F = longer spine). *Posterior telopods:* Movable finger of chela with genus-specific dentition and row of crenulated teeth. The opposite finger (2nd joint) features crenulations juxtaposed to the crenulated teeth of the movable finger and also one non-sclerotized spine on its anterior side (Fig. 56). Movable finger almost hairless. 2nd joint with some hairs on the immovable finger. Stout tip of immovable finger curved and hook-shaped (Figs. 56–57). Telopod coxa densely covered with hairs.

DISTRIBUTION AND ECOLOGY — So far this species of *Sphaeromimus* was collected only from a fragment of littoral rainforest on sand in Mandena. This particular patch of littoral rainforest is little disturbed, with 50–75% forest cover (QIT Madagascar forest map). The holotype was found in thin (5–30mm) dry leaf litter, containing mostly leaves and some tree fruits. A few winged Blattodea were found as well. A new species of genus *Zoosphaerium* (unpublished/in preparation), which occurs also in the littoral rainforest in Sainte Luce and in the eastern lowland rainforest, was common in this area (>300 mature and mostly immature where detected).

Body rings of spirostreptid and small sphaerotheriid tergites were found in a layer of arthropod remains around ant holes of a big red ant species. It is unknown how the ants are able to hunt these well-armored animals. Rolled up sphaerotheriids were placed near ants, but the ants showed no interest. A large *Zoosphaerium* specimen (34 mm long, 16 mm broad (2nd segment)) was put in a cage with one Carnivora: *Galidia elegans* inside, which was caught and kept at the Pepinière in Mandena. *Galidia* was able to detect the rolled up specimen, broke the tergites with a few bites of the lateral teeth and ate internal parts, ignoring the intestine tergite pieces. It is likely that *Galidia elegans* may represent a predator of pill millipedes, including *Sphaeromimus inexpectatus*. Predation of pill millipedes by mongoose was reported by Eisner and David (1969).

The female collected in the middle of April was carrying two eggs, suggesting that the breeding season was in progress. The forest patch of Mandena was intensively searched for 18 days during rain and at night without locating more specimens. This fact prompts us to suggest that *S. inexpectatus* is either a very rare species or was not active during the collection time. *S. inexpectatus* was not found in any other collection samples or in nearby littoral forest patches of Petriky and Sainte Luce. Additionally it was not present in the collections of CAS, FMNH or in the huge collections of the MNHN. People living in the area are familiar with pill millipedes, calling them "Mia," but were not aware of this red-colored species. These observations may indicate that *S. inexpectatus* is endemic or now restricted to the littoral forest patch of Mandena. According to the isopod fauna and vegetation (Dumetz 1999), the littoral forests of Mandena are different from those of Petriky and Sainte Luce, albeit a distance of only 20–30 km separates these.

CONSERVATION.— Currently, the observed patch of littoral forests is separated by pseudosteppe or *Eucalyptus* plantations with apparently little humus and soil arthropods (per. observation). In the past 50 years almost 73% of the original forest was destroyed (Vincelette et al. 2003). Currently, the small study area is efficiently protected by QIT Madagascar. It is however, uncer-

TABLE 3. Species separation in *Sphaeromimus*. No. = Number; gn = gnathochilarium; a.t. = anterior telopods; p.t. = posterior telopods; SR = stridulation ridges.

Character:	<i>Sphaeromimus musicus</i>	<i>Sphaeromimus splendidus</i> sp. nov.	<i>Sphaeromimus inexpectatus</i> sp. nov.
Tergite coloration:	orange with black pattern	black	pink
Body length:	up to 34.5 mm	up to 23.6 mm	at least 15 mm
No. of SR in female	7-Aug	5-May	3
No. of SR in male	5	3	3
antennal cones	up to 75	up to 45	up to 75
Sensorial cones lateral of gn-palpi	4, 1 displaced	4, all together	?
Surface of tergites	few hairs	bald	bald
Patch of hairs on the head towards the collum	present	absent	absent
Molar plate process of mandible	with 1 large step	with 2 steps	with 2 steps (2nd small)
No. of pectinate lamellae	6	7-Jul	7
No. of ocelli	>80	50-60	?
Coxal lobe of legs	weakly developed	strongly developed	nearly absent
Endotergum: marginal ridge	straight	straight	curved
Endotergum: flattened nodules	oval	rounded	rounded
Endotergum: No. of rows of marginal bristles	3-Mar	1-2	1
a.T. process of 2nd joint visible	only posterior of joint 3&4	only posterior of joint 3&4	posterior and lateral of joint 3&4
p.t.: 2nd joint	apical end stout	apical end stout	apical end hook-like

tain, whether the protected area is large enough to sustain viable populations of this species. The senior author noted the lack of old large trees in the area and wood removal by humans is ongoing.

DISCUSSION

The three species of *Sphaeromimus* are easily distinguished from each other, see Table 3. Jeekel (1974, Fig. 64 B) presented the most recent classification of the order Sphaerotheriida, while Hoffman (1976) and Mauriès (2001) modified Jeekel's classification of the sphaerotheriid family Sphaeropoeidae (Fig. 64 A). Jeekel employed characters found in the shape of the female vulva and the stridulation organs (harp in males, washboard in females) to separate tribes and subfamilies. The genus *Sphaeromimus* belongs to the family Sphaerotheriidae, sharing the main synapomorphy of its genera: basis of the vulval operculum embraced by the bursa (consisting of the exterior and inner plate, Fig. 64, character 1). Jeekel considers the presence of a female stridulation organ, the washboard (Fig. 64, character 2) as the synapomorphy for the subfamily Arthrosphaerinae, to which the genus *Sphaeromimus* is currently assigned. The other synapomorphy of the subfamily cited by Jeekel, the median protrusion of the bursa, is not present in *Sphaeromimus* (Fig. 64, character 3). In Jeekel's classification, *Zoosphaerium* and *Sphaeromimus*, the two Malagasy sphaerotheriid genera, are placed in the tribe Zoosphaeriini, based on the possession of the harp in the males (occurs in both genera, character 4). Jeekel also listed the shape of the subreniform

female operculum (character 5), as it occurs in *Zoosphaerium*, as an apomorphy of the tribe. However, now that females of *Sphaeromimus* are known, this latter apomorphy cannot be supported. Females of *Sphaeromimus* have a round operculum with a smooth edge.

Furthermore, *Sphaeromimus* shares characters with members of the Indian genus *Arthrosphaera*, currently placed by Jeekel (1974) in the tribe Arthrosphaerini of the Arthrosphaerinae. Such shared characters are: 6th antennomere flat and broad (cylindrical in *Zoosphaerium*, Fig. 64, character 8), and the four-jointed anterior telopods (Attems 1936, Fig. 64, character 9). Thus, males of *Sphaeromimus* share on the one hand a characters with the genus *Arthrosphaera* (characters 8 and 9) and on the other hand a character, the harp (character 4), with the genus *Zoosphaerium* (DeSaussure and Zehntner 1902; Pocock 1895). In *Sphaeromimus*, the washboard features a rather deep median groove (character 10) of variable length. The presence of the groove may indicate the fusion of two separate plates. In contrast, all *Zoosphaerium* species examined to date possess a completely fused subanal plate without a suture or groove. A groove is also present in at least one species of the Indian genus *Arthrosphaera*. Unfortunately, the form of the subanal plates are known for only few members of both genera. These morphological details indicate clearly that the current classification scheme (Fig. 64) lacks sufficient character support and that more characters are needed to define monophyletic clades within the Sphaerotheriida unequivocally.

ACKNOWLEDGMENTS

The senior author gratefully acknowledges the support and advice by Prof. Dr. J.-W. Wägele. We thank the Direction des Eaux et Forêts and the Commission Tripartite for their authorization to carry out this work. QIT Madagascar Minerals and their environmental and conservation team headed by Manon Vincelette and Jean-Baptiste Ramanamanjato provided excellent support. The paper is part of the Accords de Collaboration between the Université d'Antananarivo (Dept. Biologie Animale and Anthropologie et Biologie Evolutive), QIT Madagascar Minerals and Hamburg University. The support by O. Ramilijaona and D. Rakotondravony is gratefully acknowledged. During fieldwork QIT Madagascar provided logistics support (arranged by J.B. Ramanamanjato). Collecting permits were arranged by Dr. O. Ramilijaona (Department de Biologie Animale, Université d'Antananarivo). Special thanks go to the Direction des Eaux et Forêts, Antananarivo for arranging collecting and export permits. The senior author conducted the fieldwork on an expedition organized by Prof. Dr. J.U. Ganzhorn (University of Hamburg). Expenses for the fieldwork were defrayed through personal funds. We thank Mr. Charles E. Griswold and Mr. Darrell Ubick (California Academy of Sciences) for the loan of material. Special thanks go to Dr. C. Schmidt (Ruhr-University Bochum) for continuous advice throughout the study. Ms B. Strack (Field Museum) assisted us during the preparation of the SEM images. We thank Drs. VandenSpiegel, Hamer and Ganzhorn for helpful suggestions on previous drafts of the manuscript. A one-month internship of the senior author at the Field Museum of Natural History and the work on the manuscript was supported by NSF grant DEB 97-12438 to P. Sierwald and W.A. Shear (Hampden-Sydney College, Virginia). A 20-day visit of the senior author at the Muséum National d'Histoire Naturelle to study the type collection and the undetermined material was supported by Synthesys grant FR-TAF-186. Special thanks go to J.-J. Geoffroy and L.E. Leoz for the organisation of this visit.

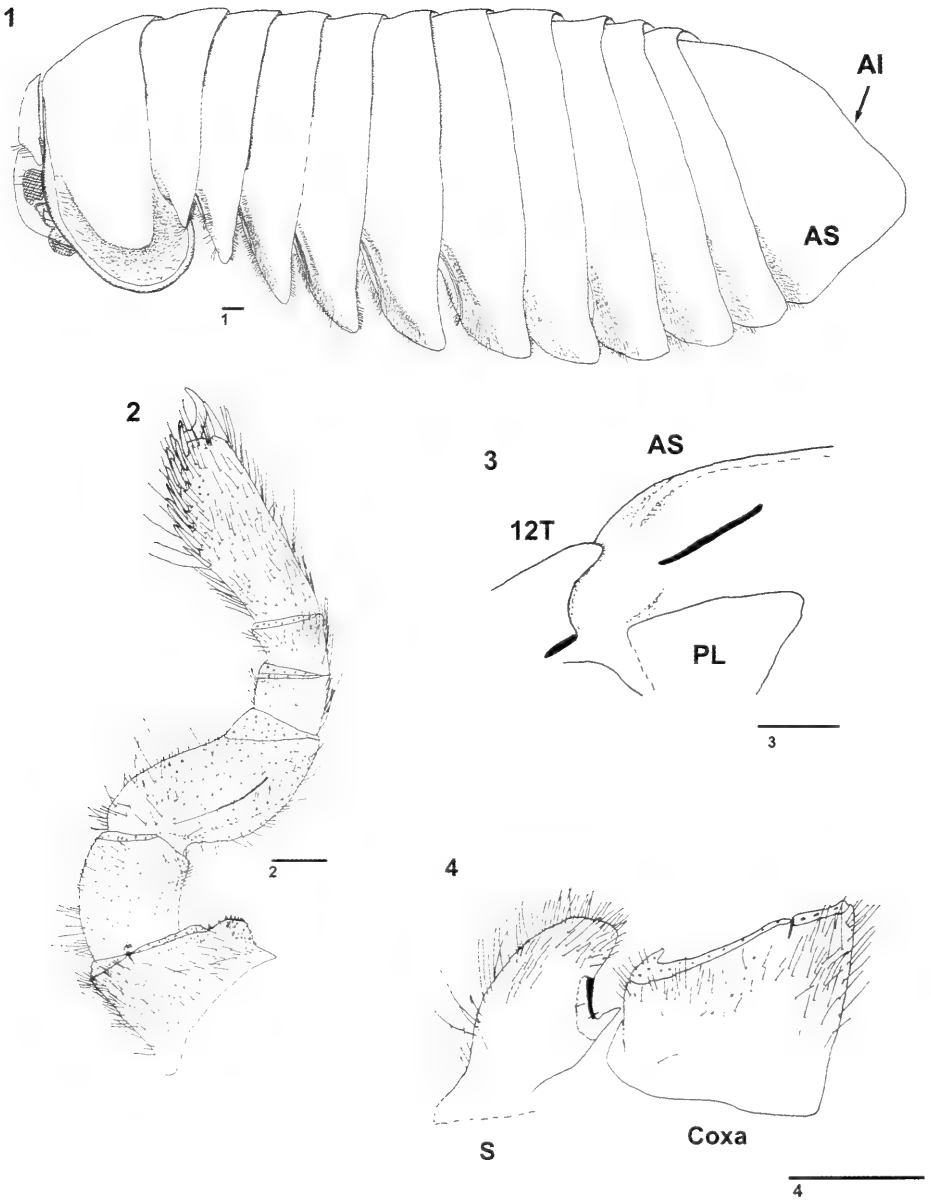
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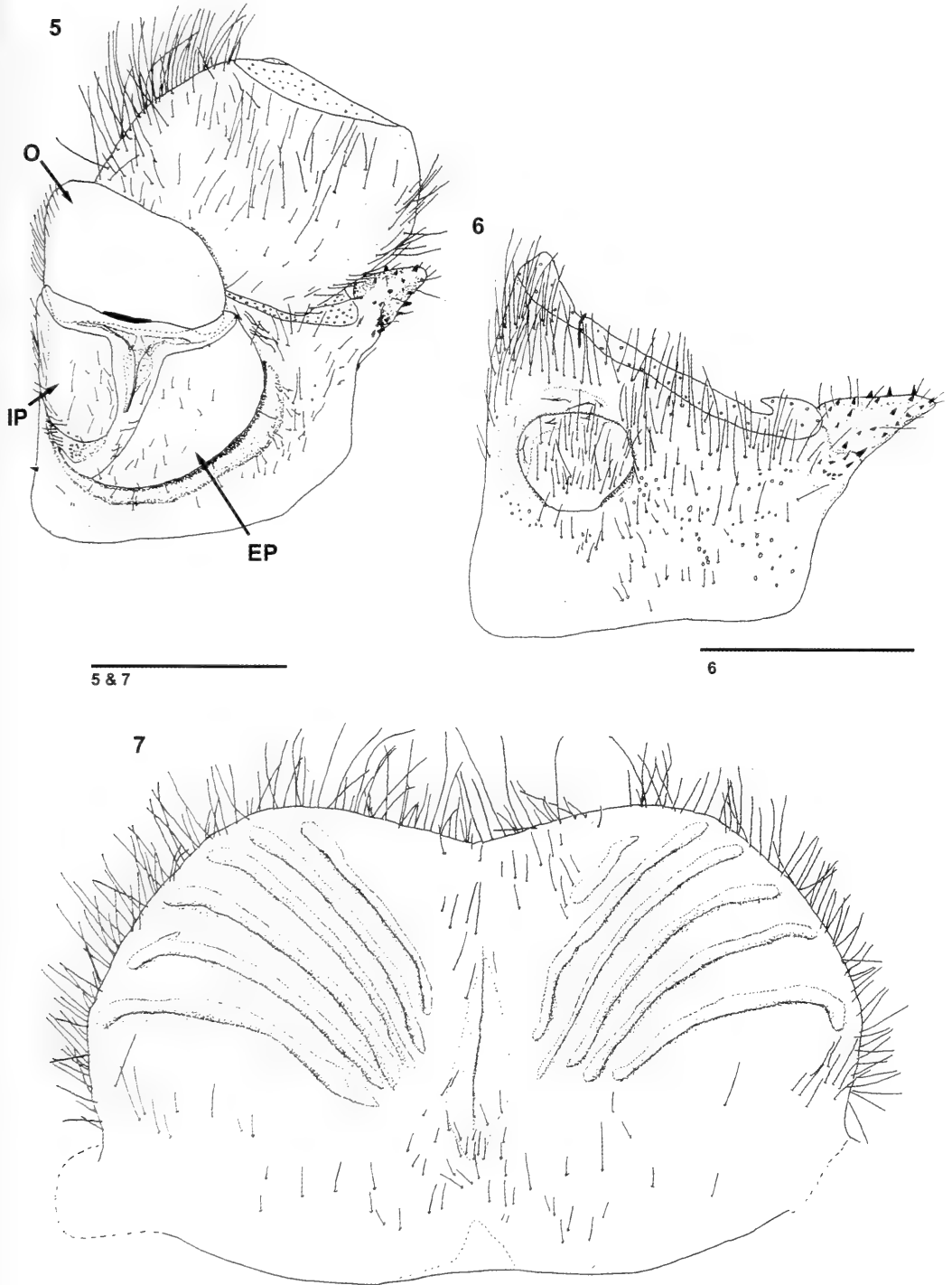
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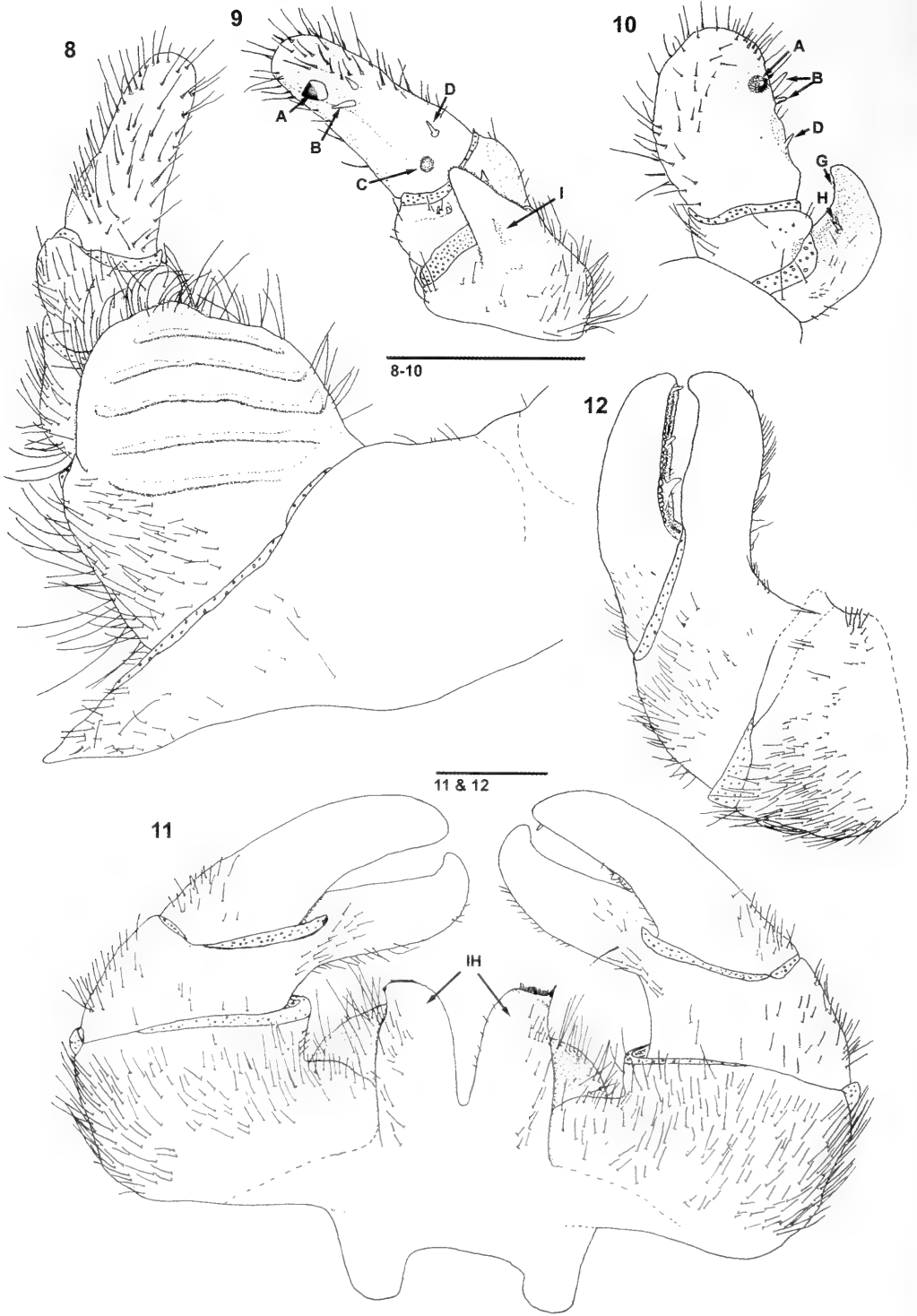
ILLUSTRATIONS



FIGURES 1-4. *Sphaeromimus musicus*, male. 1: habitus; 2: left 9th leg, posterior view; 3: anal shield, dorsal view of black locking carinae; 4: 1st right sternite with coxa of 1st pair of legs. AI = invagination of anal shield; 12T = 12th tergite; PL = pleurite; AS = anal shield; S = sternite. Scale bars: 1 mm.



FIGURES 5-7. *Sphaeromimus musicus*, female and male. 5: 2nd left leg: coxa (female) with vulva; 6: 2nd left leg: coxa (male), posterior view; 7: washboard. O = operculum; IP = inner plate; EP = exterior plate. Scale bars: 1 mm.



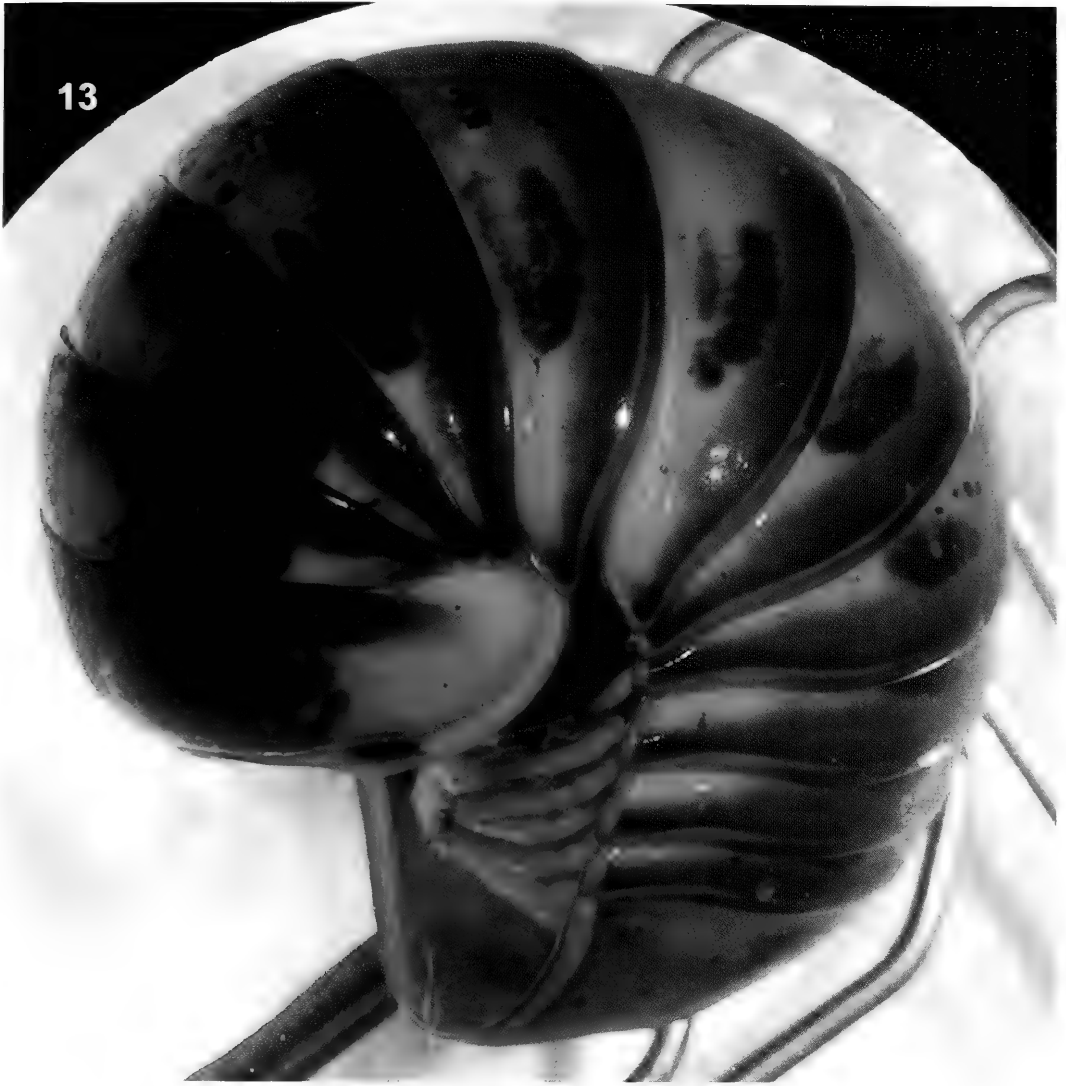
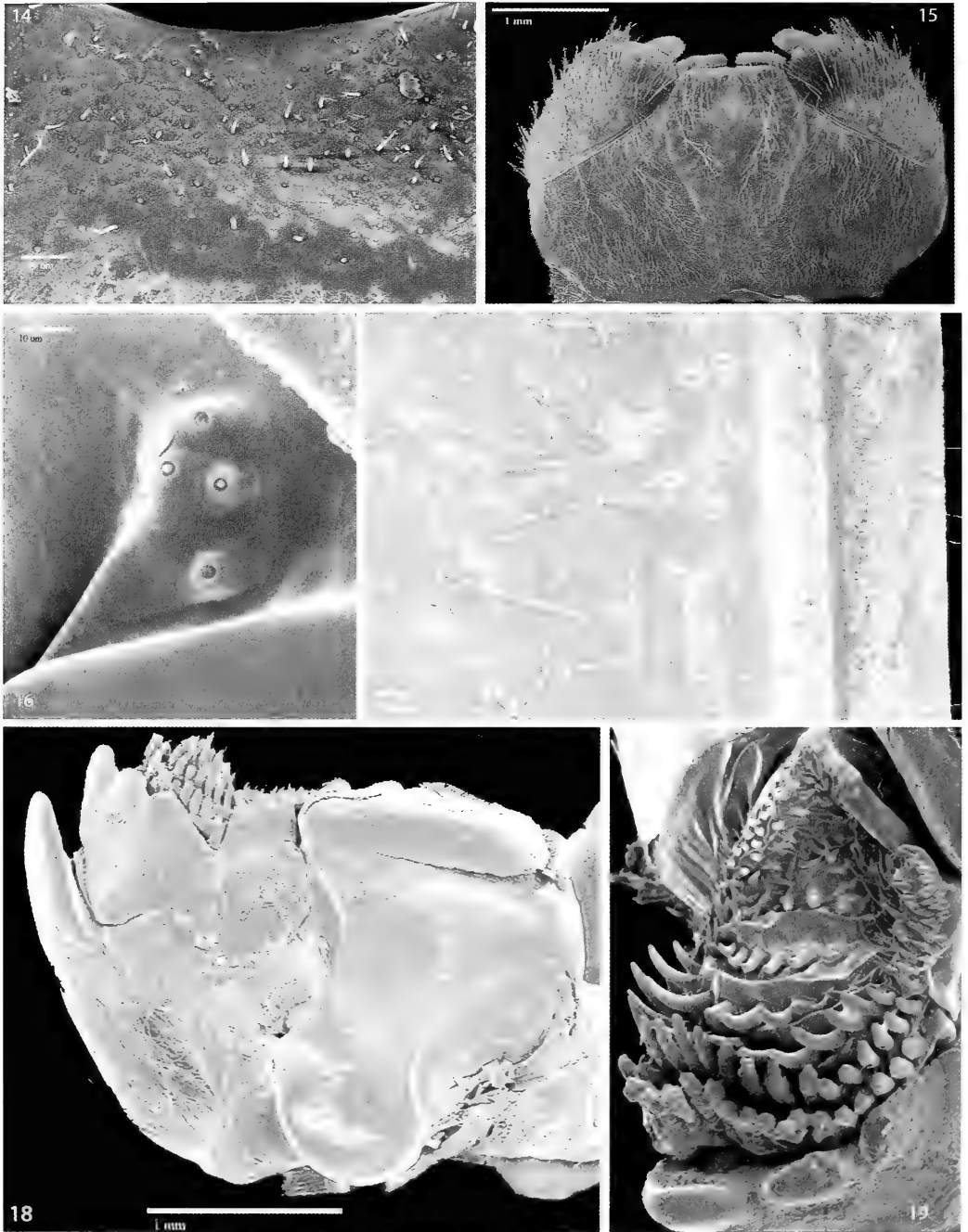


FIGURE 13 (above). *Sphaeromimus musicus*. Photo of freshly preserved male.

FIGURES 8–12 (left). *Sphaeromimus musicus*, male. 8: left anterior telopod, anterior view; 9: left anterior telopod, posterior view; 10: anterior telopod, lateral view; 11: posterior telopods, anterior view; 12: posterior right telopod, posterior view. A = 4th joint big spine; B = 4th joint 2 small spines; C = 4th joint knob; D = 4th joint 1 small lateral spine; I = 2nd joint sensorial hairs; G = 2nd joint lobe crenulation; H = 2nd joint lobe 2 spines; IH = inner horns. Scale bars: 1 mm.



FIGURES 14–19. *Sphaeromimus musicus*, male SEM. 14: patch of hairs on head to collum; 15: gnathochilarium, ventral view; 16: field of sensorial cones lateral of palpi of gnathochilarium; 17: endotergum 18: right mandible, general view; 19: right mandible, pectinate lamellae.

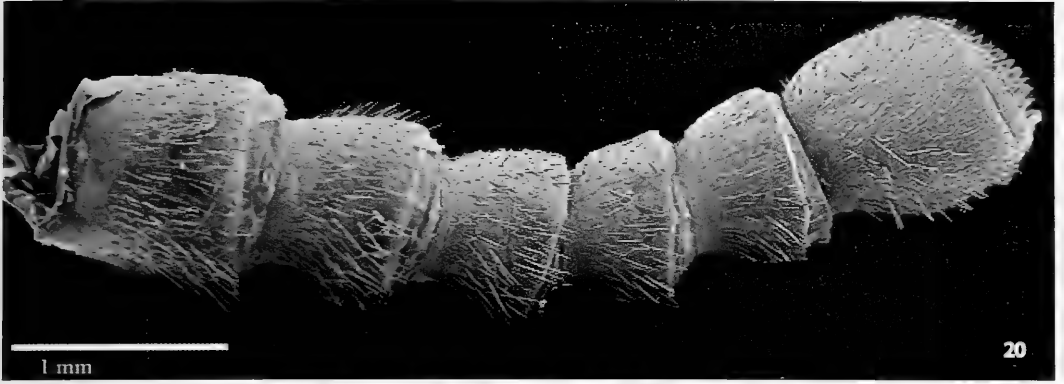
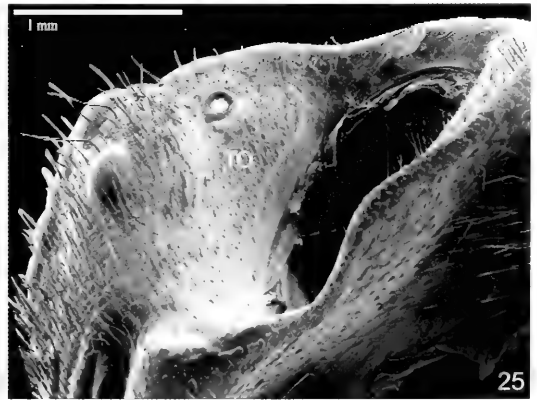
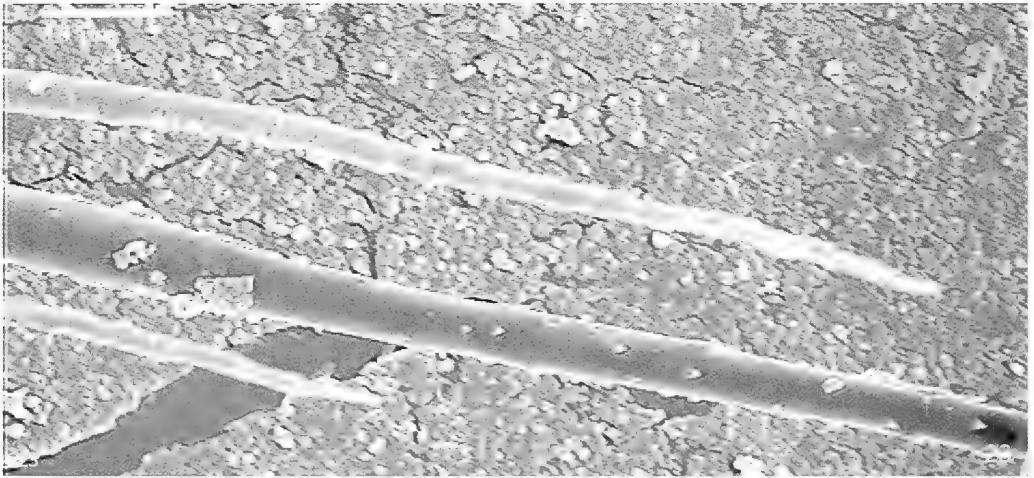
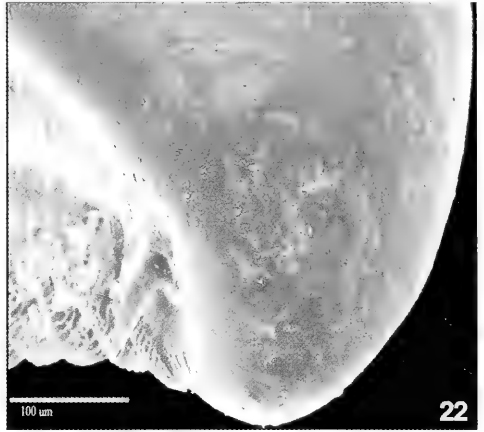
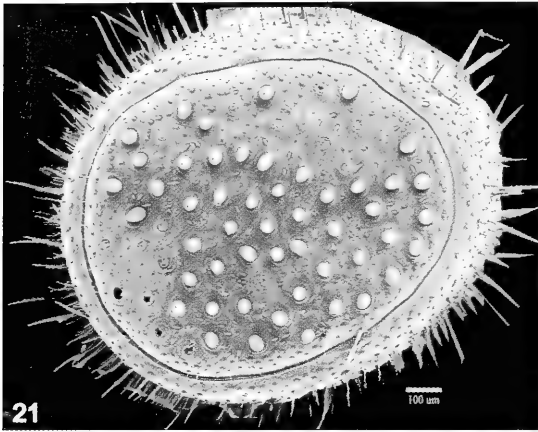


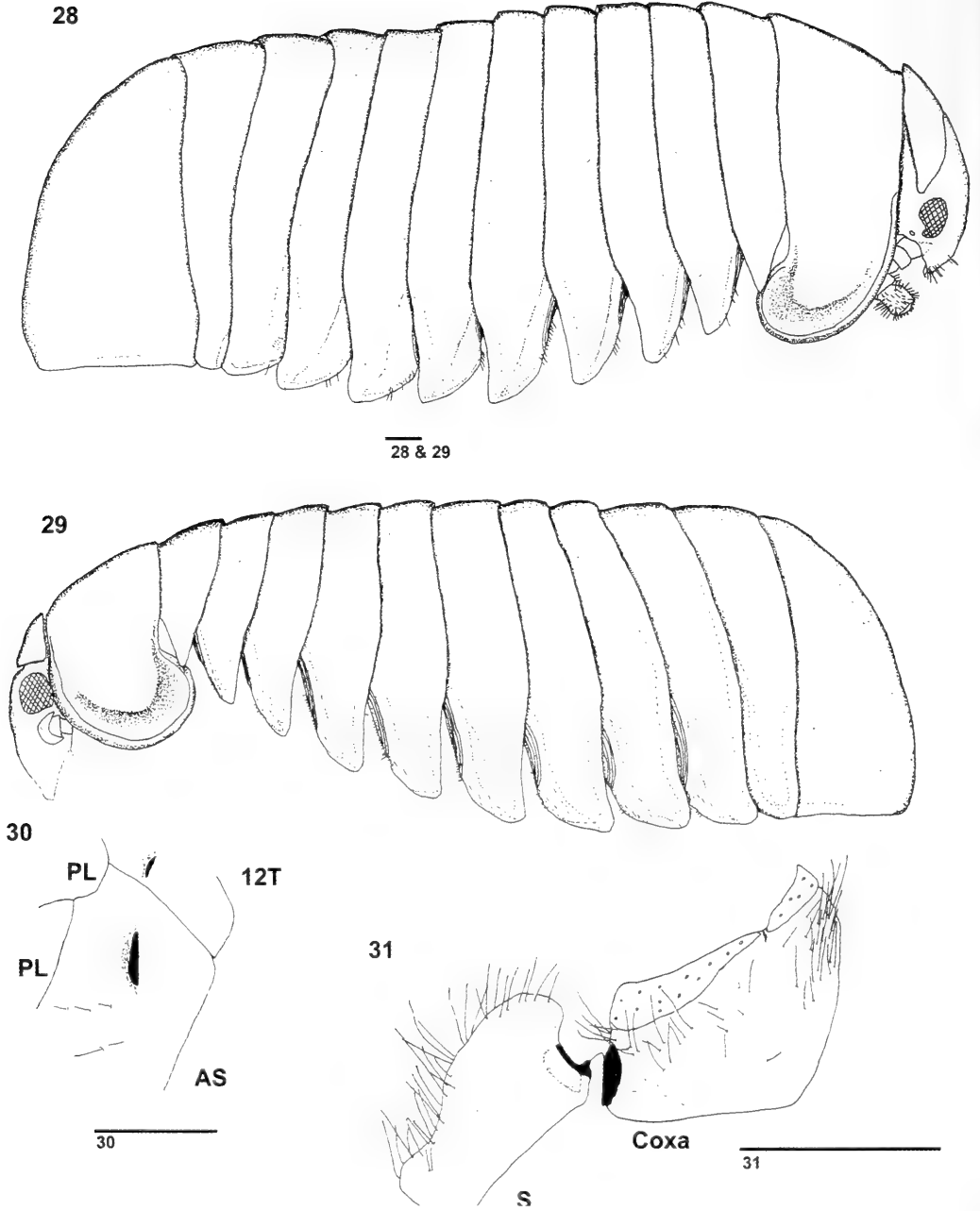
FIGURE 20. *Sphaeromimus musicus*, male SEM, antennae, lateral view.



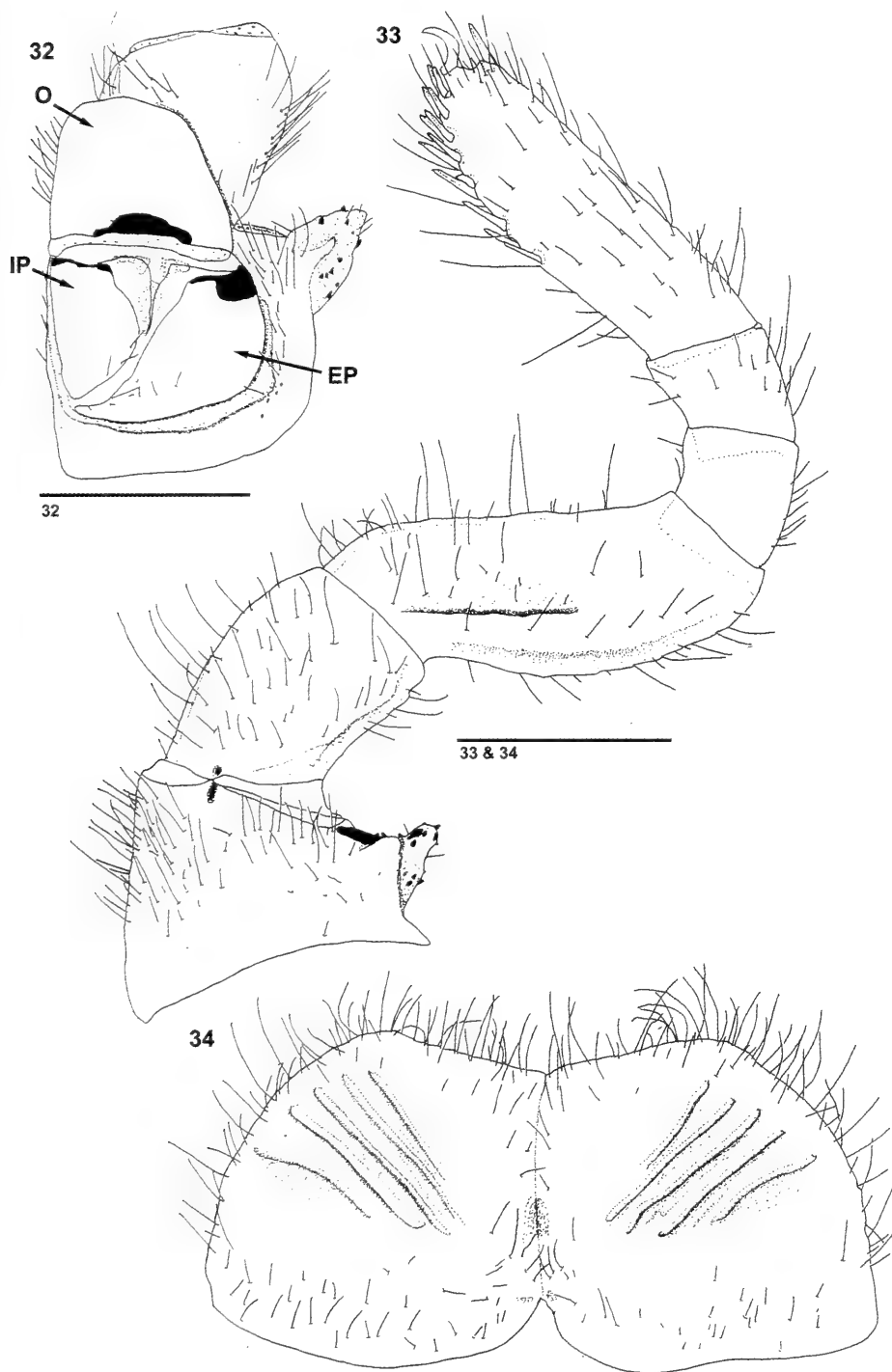
FIGURES 21–25. *Sphaeromimus musicus*, male SEM. 21: 6th joint of antennae; 22: apical part of movable finger of posterior right telopod; 23: bristle of endotergum; 24: right ocelli; 25: antennal groove with Tömösváry organ (TO) and aberrant ocellus.



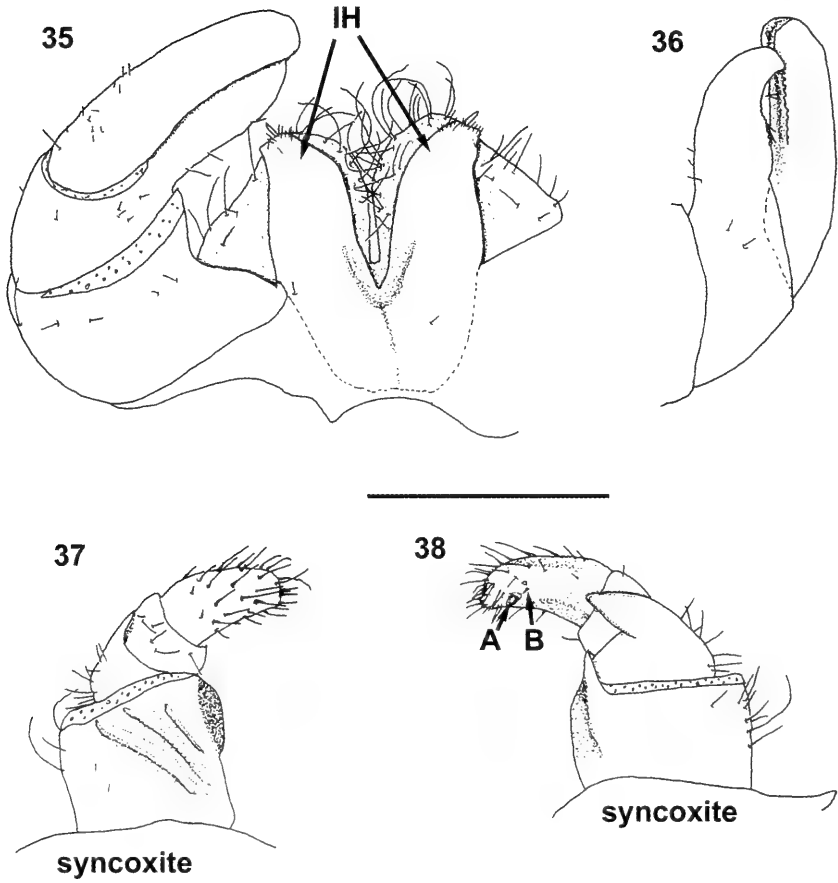
FIGURES 26–27. *Sphaeromimus musicus*, male SEM. 26: posterior side of 9th femur with toothed ridge; 27: 2nd coxa, posterior view, coxal lobe and male gonopode.



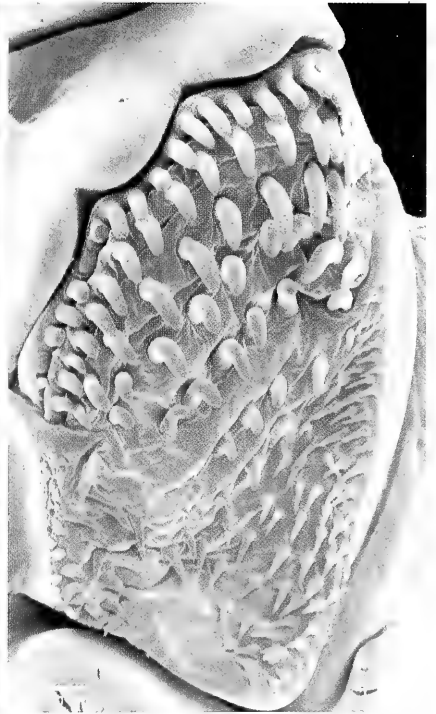
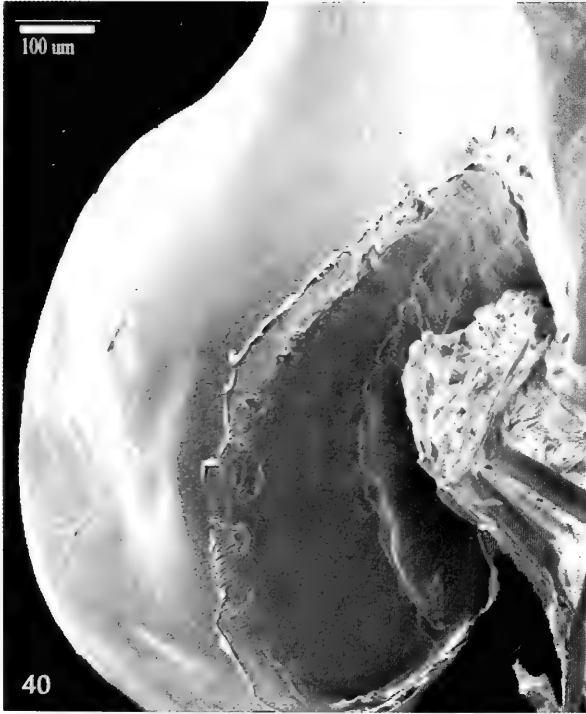
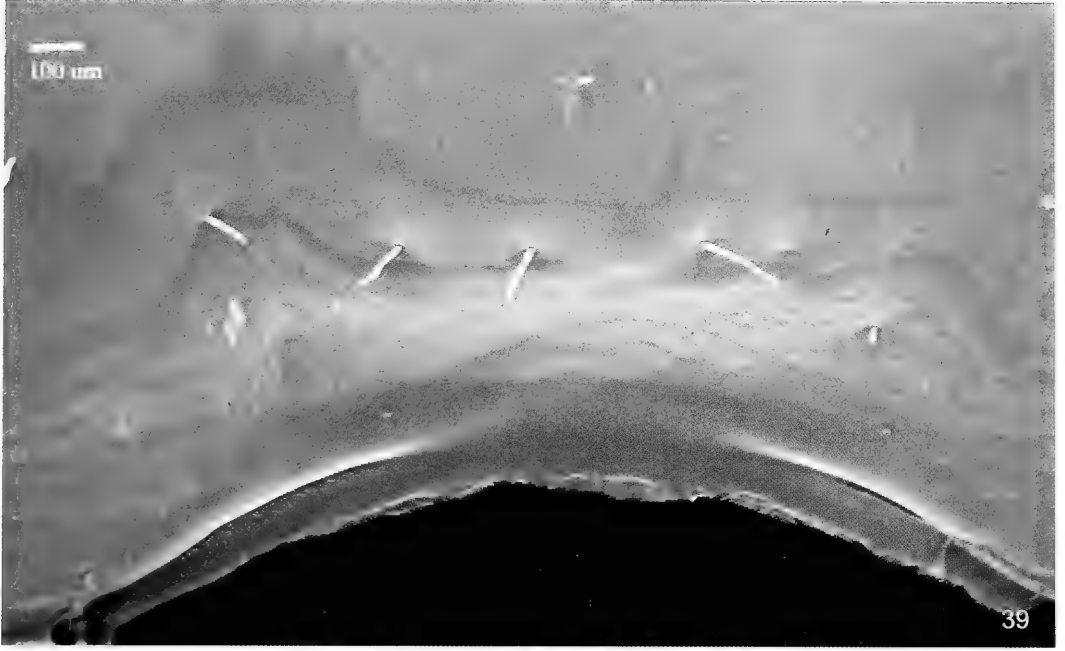
FIGURES 28–31. *Sphaeromimus splendidus*, female holotype. 28: habitus, right side; 29: habitus, left side; 30: anal shield, dorsal view of black locking carinae; 31: 1st right sternite; 12T = 12th tergite; AS = anal shield; PL = pleurite; S = sternite. Scale bars: 1 mm.



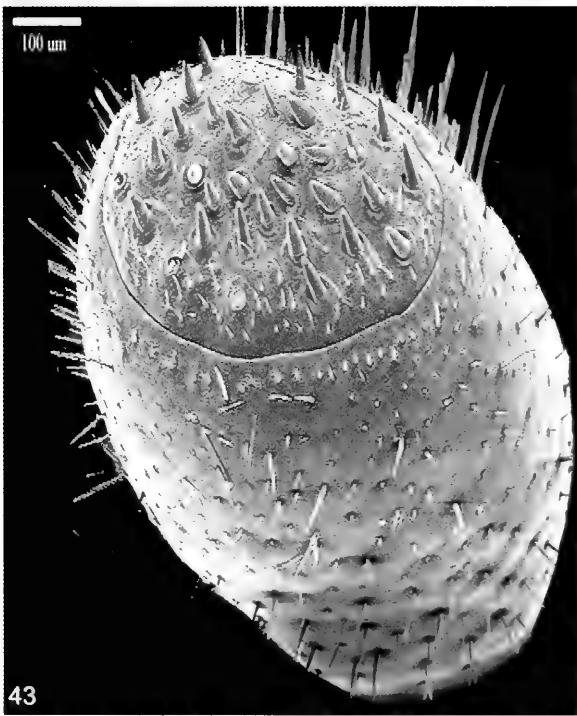
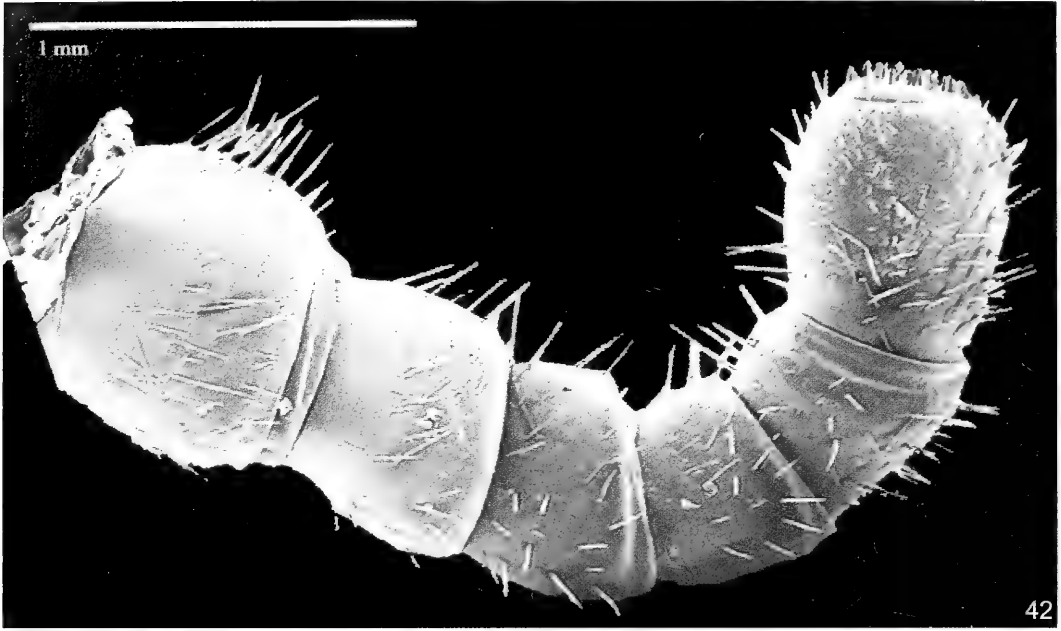
FIGURES 32-34. *Sphaeromimus splendidus*, female holotype. 32: left vulva; 33: left 9th leg, posterior view; 34: wash-board; O = operculum; IP = inner plate; EP = exterior plate. Scale bar: 1 mm.



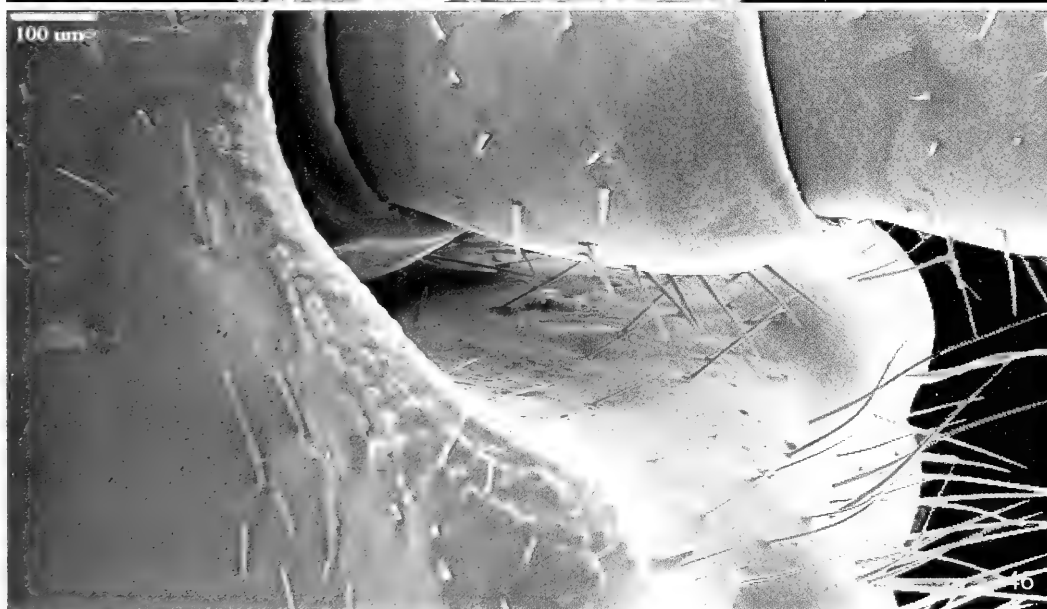
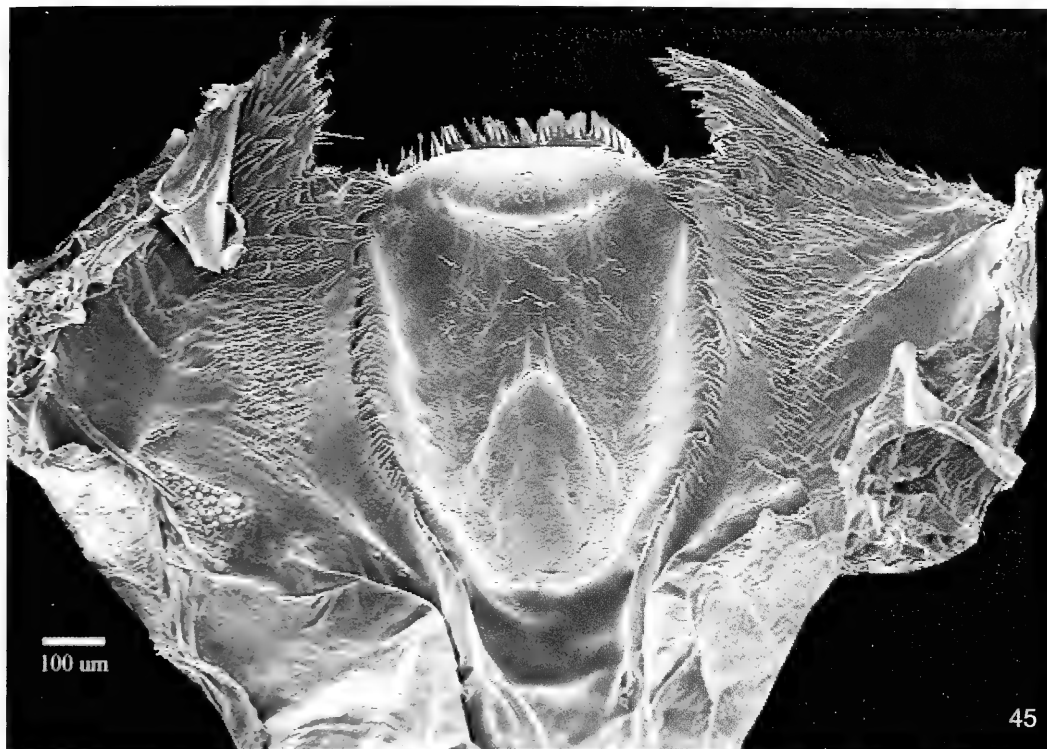
FIGURES 35–38. *Sphaeromimus splendidus*, male paratype. 35: left posterior telopod, anterior view; 36: left posterior telopod, posterior view; 37: left anterior telopod, anterior view; 38: left anterior telopod, posterior view; A = big spine; B = two small spines; IH = inner horns. Scale bar: 1 mm.



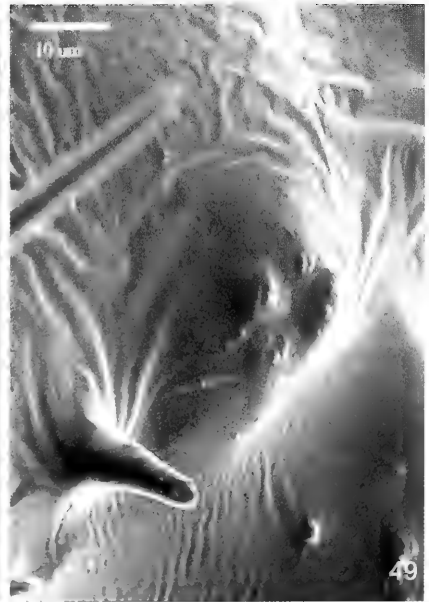
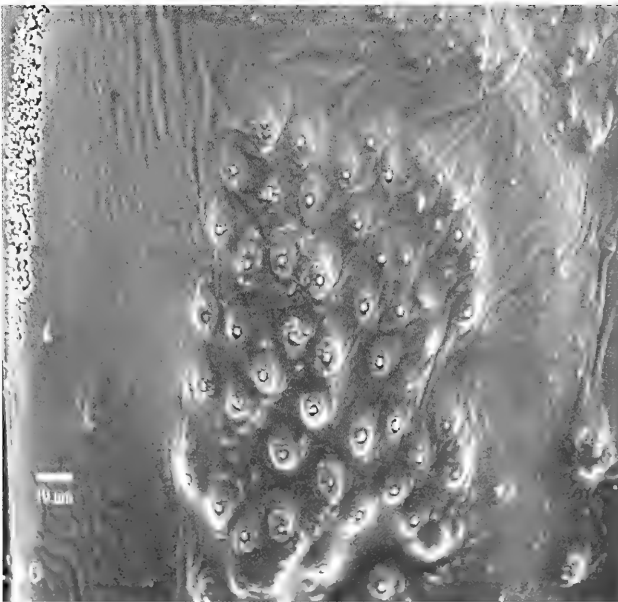
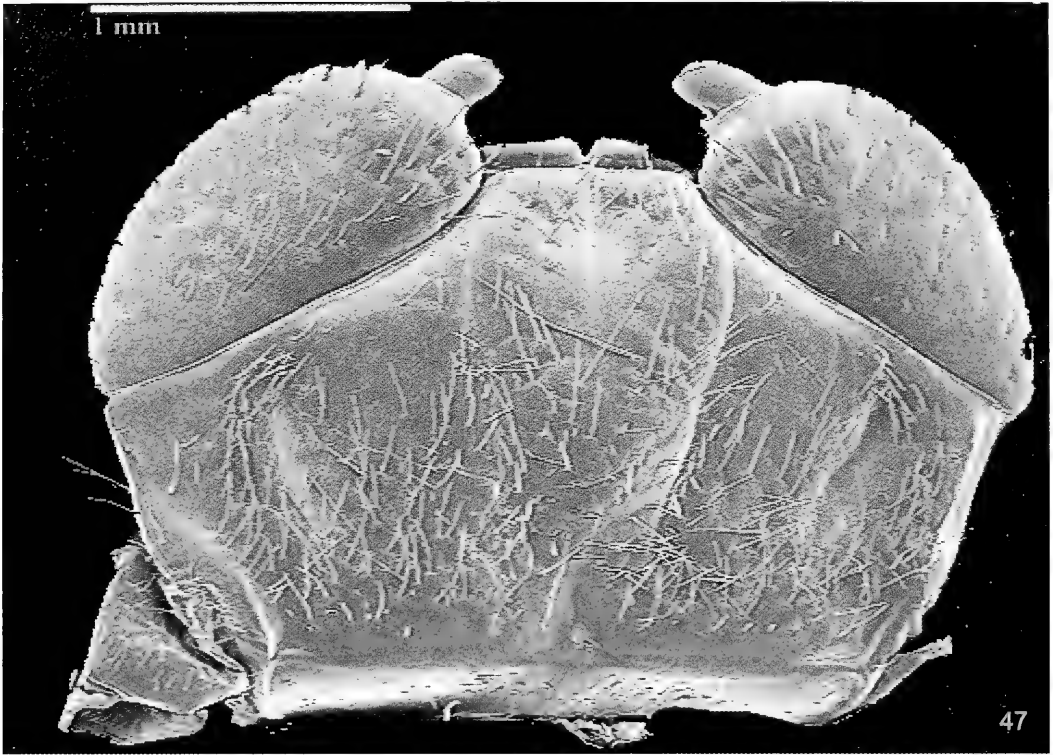
FIGURES 39–41. *Sphaeromimus splendidus*, female SEM. 39: patch of hairs on head to collum; 40: right mandible, molar plate process; 41: right mandible, pectinate lamellae.



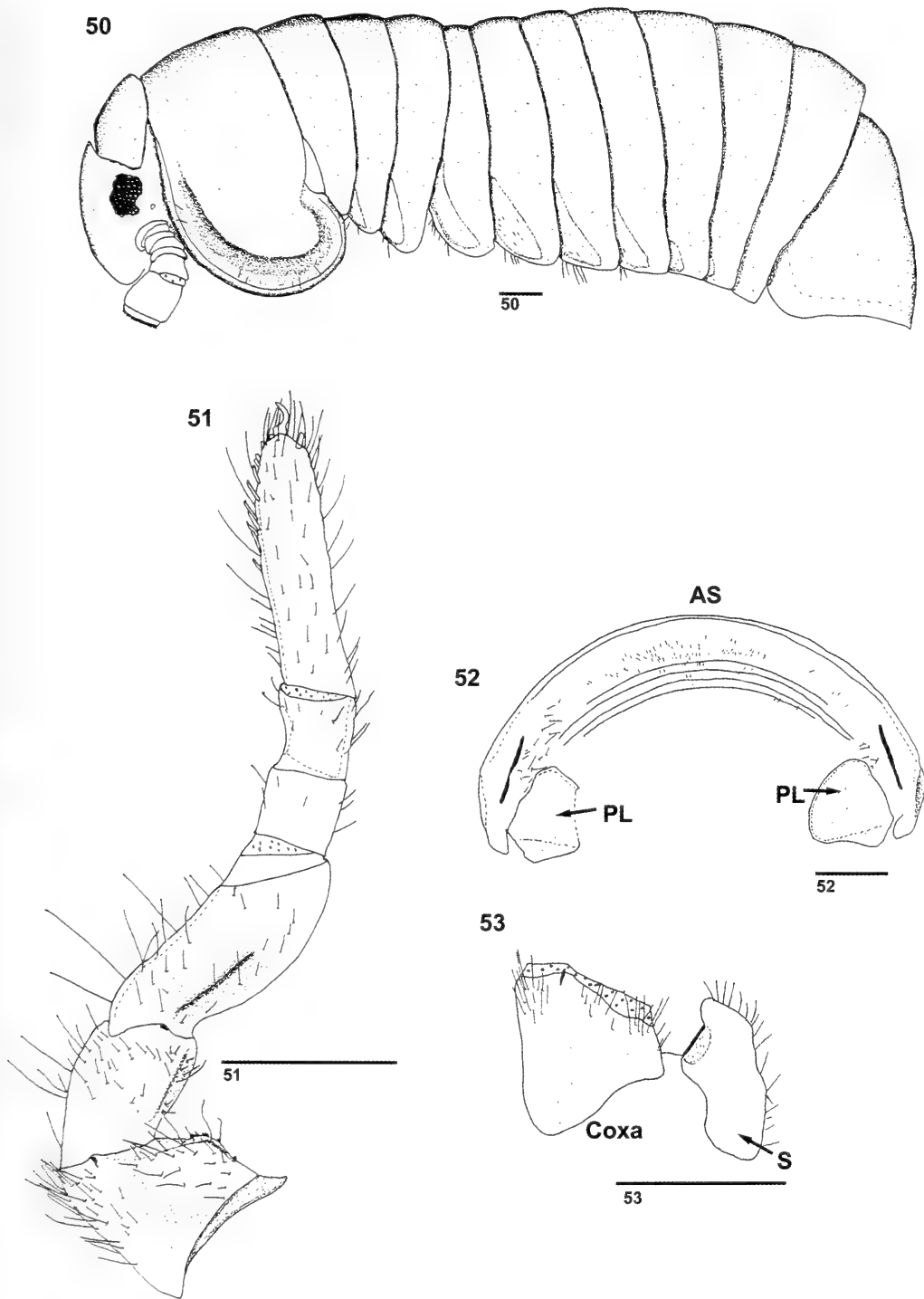
FIGURES 42–44. *Sphaeromimus splendidus*, female SEM. 42: antennae lateral; 43: 6th antennomere; 44: endotergum.



FIGURES 45-46. *Sphaeromimus splendidus*, female SEM. 45: epipharynx, anterior side; 46: edges of antennal groove with crenulated teeth and one spine.

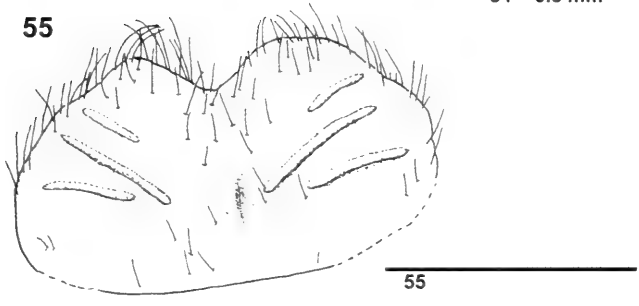
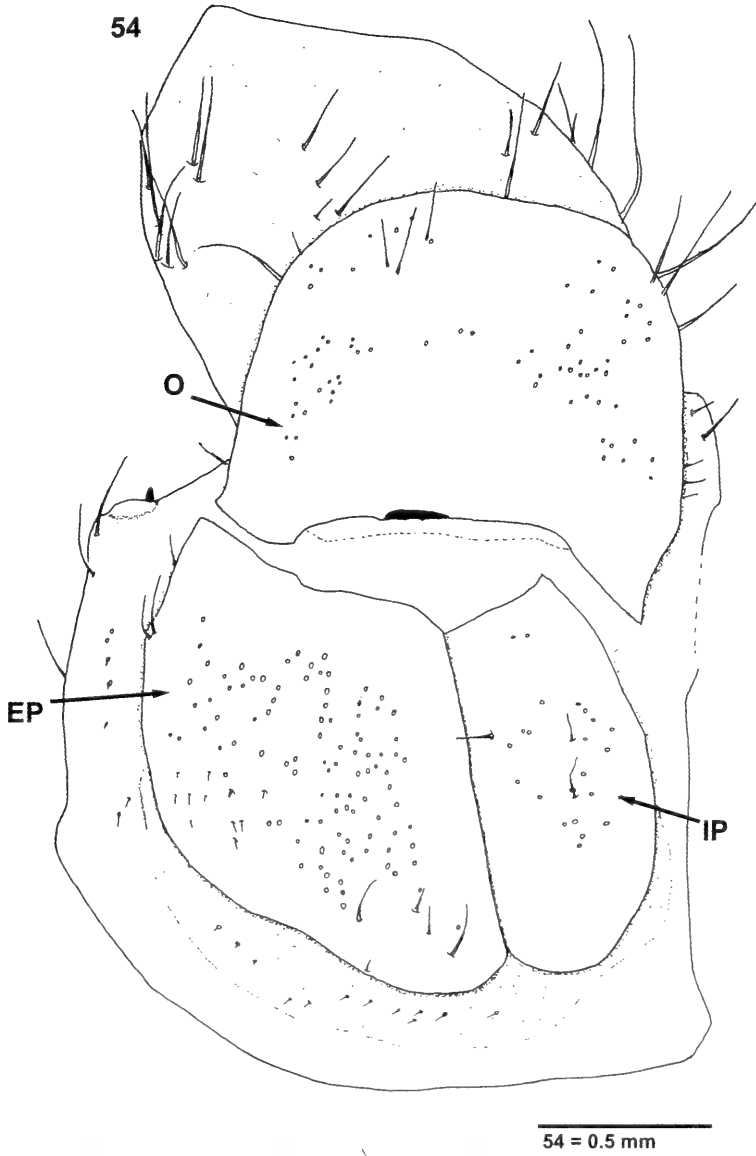


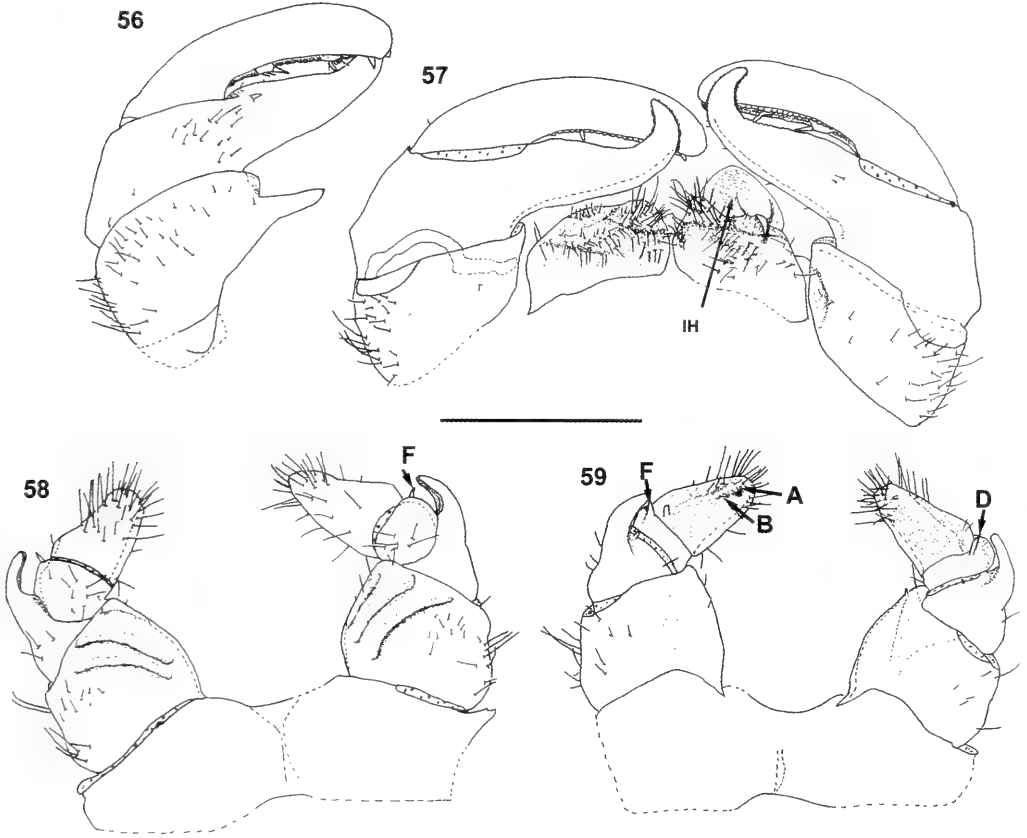
FIGURES 47–49. *Sphaeromimus splendidus*, female SEM gnathochilarium. 47: gnathochilarium, ventral view; 48: sensal cones on medial pads; 49: pit laterally of palpi with sensal cones.



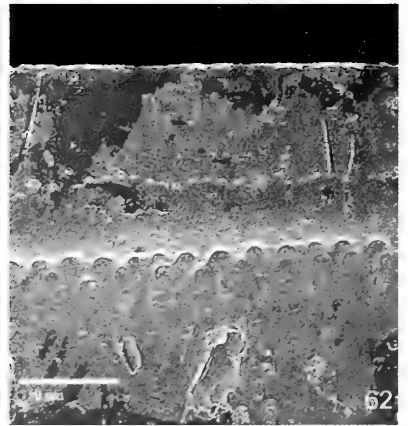
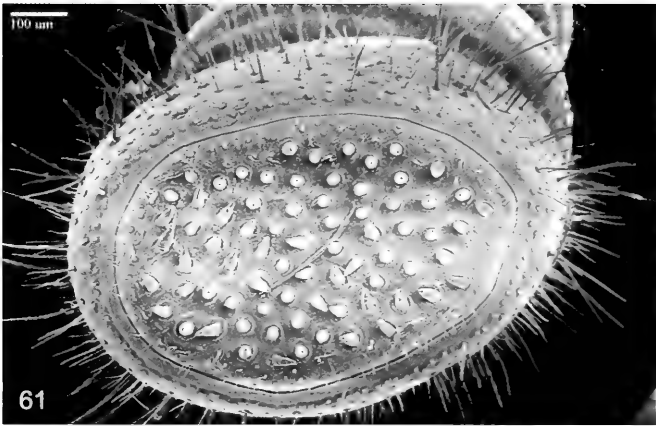
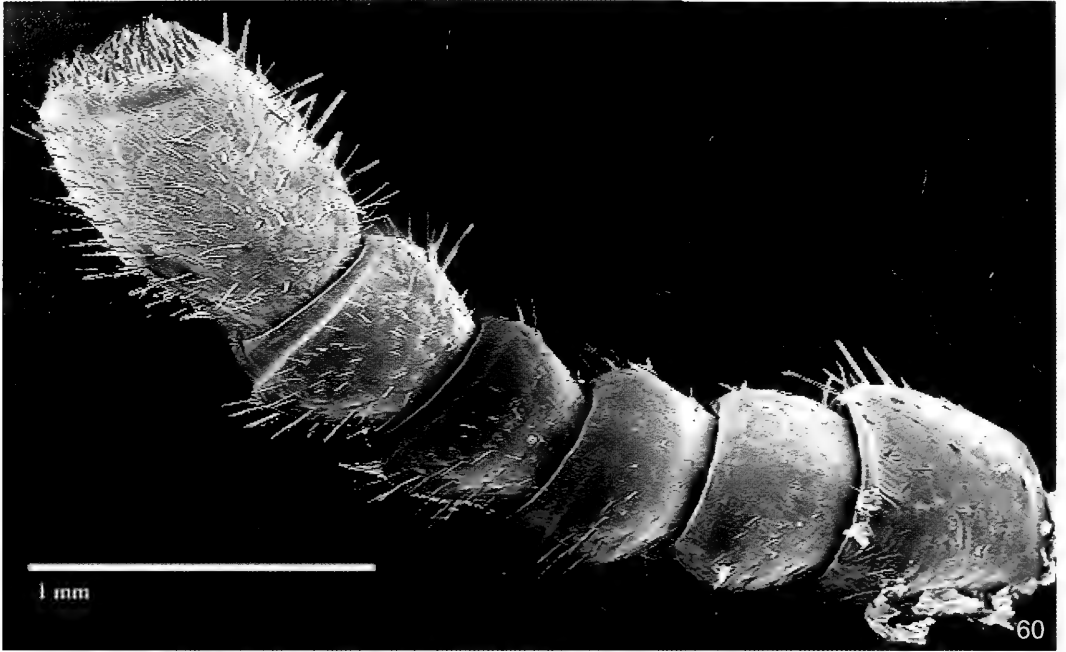
FIGURES 50–53. *Sphaeromimus inexpectatus*, male holotype. 50: habitus; 51: left 9th leg, posterior view; 52: anal shield, dorsal view of black locking carinae; 53: left 1st sternite; AS = anal shield, PL = pleurite; S = sternite. Scale bars: 1 mm.

FIGURES 54-55. *Sphaeromimus inexpectatus*, female paratype; 54: vulva (macerated); 55: washboard right; O = operculum; IP = inner plate; EP = exterior plate. Scale bars: 0.5 and 1 mm.





FIGURES 56-59: *Sphaeromimus inexpectatus*, male holotype; 56, left posterior telopod, posterior view; 57, posterior telopods, anterior view; 58, anterior telopods, anterior view; 59, anterior telopods, posterior view; A = big spine; B = two small spines; D = small lateral spine; F = longer spine; IH = inner horns of posterior telopod. Scale bar: 1 mm.



FIGURES 60–62. *Sphaeromimus inexpectatus*, male holotype SEM. 60: antennae lateral; 61: 6th antennomere; 62: endotergum.

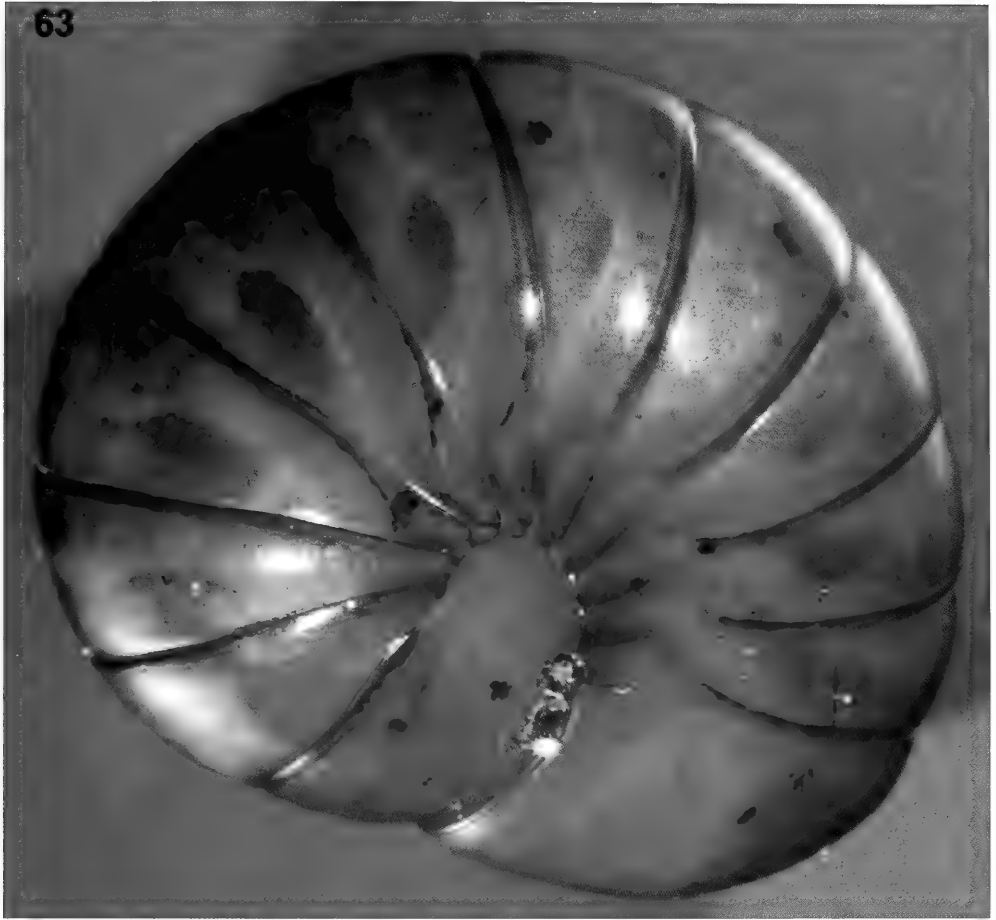
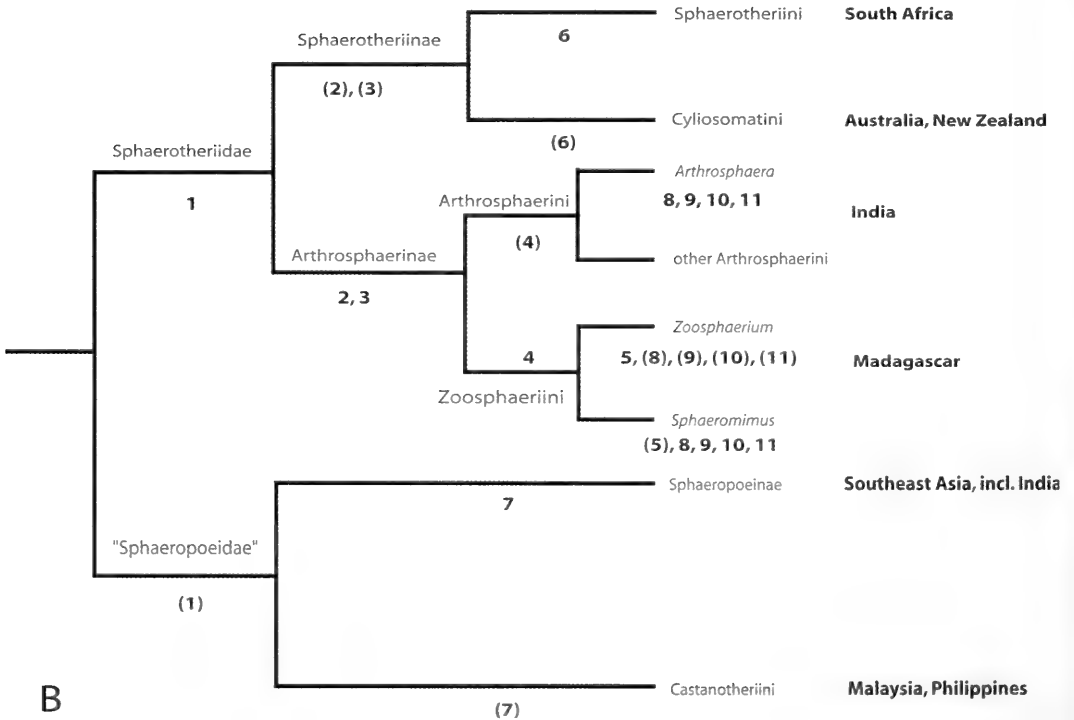
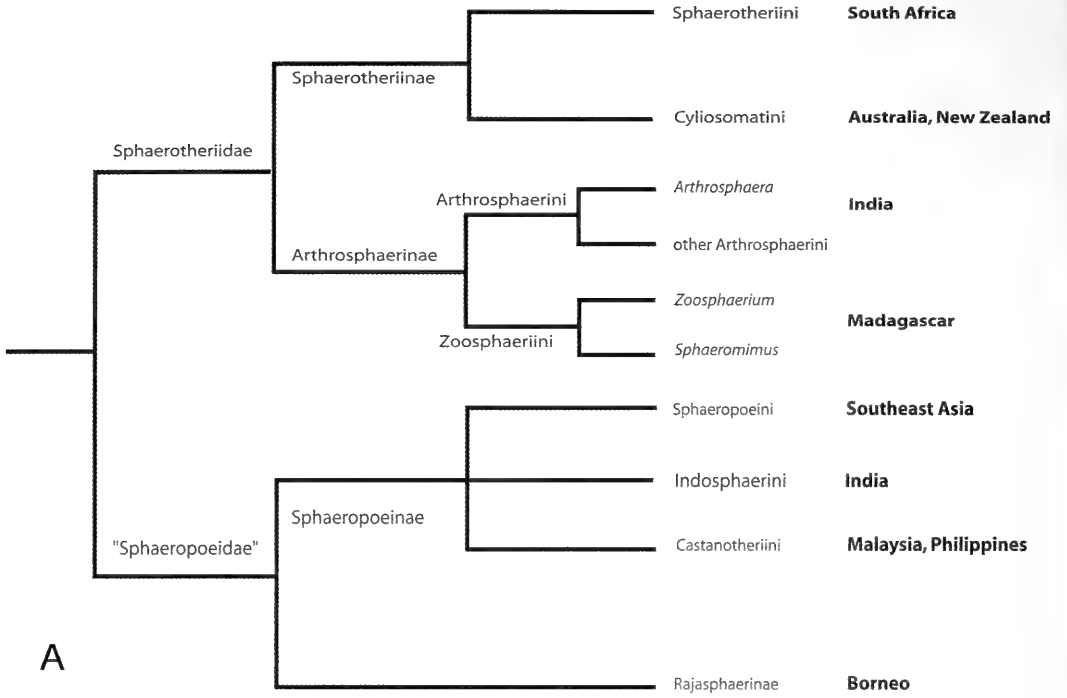


FIGURE 63. *Sphaeromimus inexpectatus*, male holotype, photo.



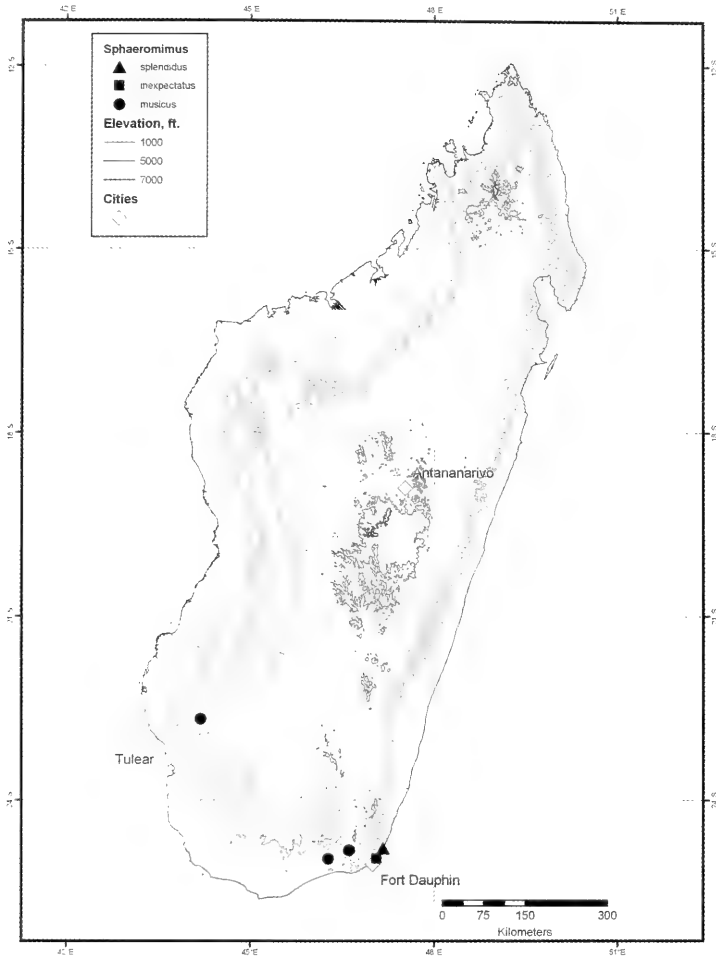


FIGURE 65. Distribution map of *Sphaeromimus*.

FIGURE 64 (left). Classification of the order Sphaerotheriida translated into a cladogram, with geographical distributions of clades. A. After Hoffman 1976, 1980, with modifications by Mauriès 2001 incorporated. B. After Jeekel 1974. Shelley (2003) recommended use of the family name Zephronidae instead of “Sphaeropoecidae.” Numbers 1-7 on branches of Fig. 64 B indicate group-defining characters used by Jeekel (1974), numbers in parentheses indicate absence of character; 1=vulval operculum embraced by bursa, 2=female washboard present, 3= medium protrusion of bursa, 4= male harp present at anterior telopod, 5= vulval operculum subreniform, 6= stridulation organ on posterior male telopods, 7= movable digit of posterior telopod consists of two distinct podomeres, (7)= movable digit of posterior telopod consists of single podomere. Numbers 8-10 indicate characters and their distributions discussed in this study: 8= 6th antennomere flat and broad, (8)=6th antennomere cylindrical, 9= four-jointed anterior telopod in males, 10= female washboard divided (known from only a single *Arthrosphaera* species), (10)= female washboard undivided (with other variable features in *Zoosphaerium*), 11= operculum well rounded, (11)= operculum with central depression.

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**A Remarkable New Species of *Acropyga*
(Hymenoptera: Formicidae) from Gabon,
with a Key to the Afrotropical Species**

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A new species of *Acropyga*, *A. bakwele* sp. nov., is described from Gabon. This is an intriguing species because unlike any other known because its worker possesses a median ocellus, unlike any other known *Acropyga*. This species is the largest *Acropyga* known from Africa, and one of the largest in the world. In overall appearance, the worker resembles the southern African *A. arnoldi*. A key to Afrotropical *Acropyga* is provided.

KEYWORDS: *Acropyga*, Afrotropical, Formicinae, Gabon, Hymenoptera, Lasiini, trophophoresy.

Acropyga are small formicine ants known for their habit of tending mealybugs underground on plant roots (Bünzli 1935; Weber 1944; Johnson et al. 2001; LaPolla et al. 2002). The relationship between the ants and mealybugs is complex (LaPolla et al. 2002; LaPolla 2004), and perhaps the most spectacular expression of this complexity is the fact that virgin queens emerge from their birth nests carrying a mealybug between their mandibles to presumably serve as a seed individual for the new ant colony. This behavior has been termed trophophoresy (LaPolla et al. 2002).

A recent world revision of *Acropyga* revealed 37 species (LaPolla 2004). One of the surprising results of that study was the lack of *Acropyga* species diversity from the rainforests of West and Central Africa. In other rainforest areas, such as in Southeast Asia and the Neotropics, *Acropyga* species diversity surpasses at least a dozen species in each region. LaPolla (2004) reported only two species from Africa, *A. arnoldi* and *A. silvestrii*. It remained unclear if Africa simply possessed a lower number of *Acropyga* species for unknown reasons (there are now a total of three species known from the continent), but the relatively few collections from western and central Africa may be indicative of a collecting artifact. In support of a collecting bias giving a lower number of *Acropyga* species than actually present in West and Central Africa, we report here on a new, interesting species recently collected in Gabon. Given the recent world revision by LaPolla (2004), we were able to recognize this new species and place it within a comparative framework.

MATERIALS AND METHODS

In February 1998, BLF participated in a biological inventory of the Minkébé forest, an area of about 32,000 km², in northeastern Gabon. Goodman et al. (2001) provides additional details on the inventory. The Minkébé forest is composed of a large block of Guineo-Congo lowland forest that drains a vast area. The northern area of that forest is part of the Ntem River watershed and the rest enters into the Ivindo River. The inventory was near the northwestern boundary of the Minkébé

Protected Area in an area of pockets of mixed heterogeneous and Maranthaceae forests within a vast area of marshland. This region is part of the Aya River drainage, which forms one of the main tributaries of the Ntem River. Our camp was in place between 5 and 17 February 1998 and was located in the Province de Woleu-Ntem, 28 km ESE Minvoul 2°05.2'N, 12°22.5'E, 600 m a.s.l. We began our trek into the forest from the Baka village of Doumasi, along the Ntem and to the east of Minvoul. Three distinct habitats types were found adjacent to the camp: marshlands dominated by *Raphia*, heterogeneous forest, and homogeneous forest composed of *Gilbertiodendron*. The leaf litter transect that collected the *Acropyga* described here (BLF1684) was from forest adjacent to the marsh. The soil was moist and sandy.

All measurements were taken at 80 × power with a Leica MZ 12 microscope using an orthogonal pair of micrometers and recorded to the nearest 0.001mm and rounded to two decimal places for presentation. All measurements are given in millimeters. Digital images (Figs. 1–4) were created using a JVC KY-F75 digital camera and Syncrosopy Auto-Montage (v 5.0) software. Morphological terminology employed throughout follows Bolton (1994), with modifications where noted. Anatomical abbreviations are elaborated here:

TL: Total Length: HL+ML+GL.

HL: Head length: the length of the head proper, excluding the mandibles; measured in full-face view from the midpoint of the anterior clypeal margin to a line drawn across the posterior margin from its highest points (to accommodate species where the posterior margin is concave).

HW: Head Width: the maximum width of the head in full-face view (excluding the portion of the eyes that extend past the lateral sides of the head).

SL: Scape Length: the maximum straight line of the antennal scape excluding the condylar bulb.

ML: Mesosoma Length: the length of the mesosoma (=alitrunk) in lateral view from the anterior most point of the pronotum (including the "neck" of the pronotum) to the posteriormost point of the metapleuron.

GL: Gaster Length: the length of the gaster in lateral view from the anteriormost point of first gastral segment (third abdominal segment) to the posteriormost point of the acidopore.

CI: Cephalic Index: $HW = 100/HL$.

SI: Scape Index: $SL = 100/HW$.

SYSTEMATIC TREATMENT

Acropyga bakwele LaPolla and Fisher, sp. nov.

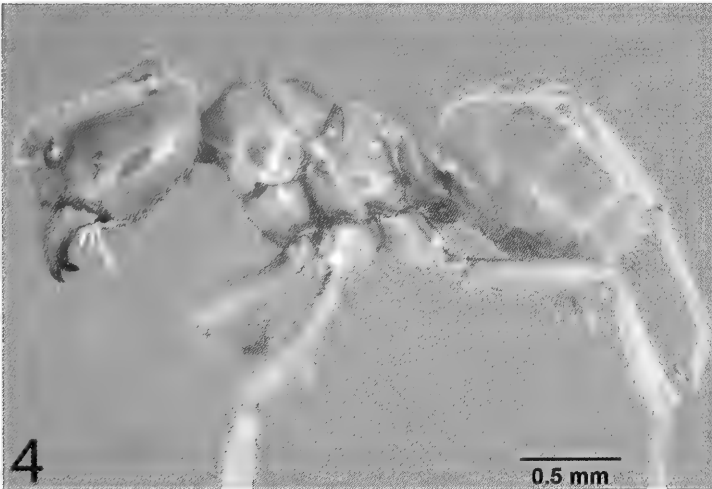
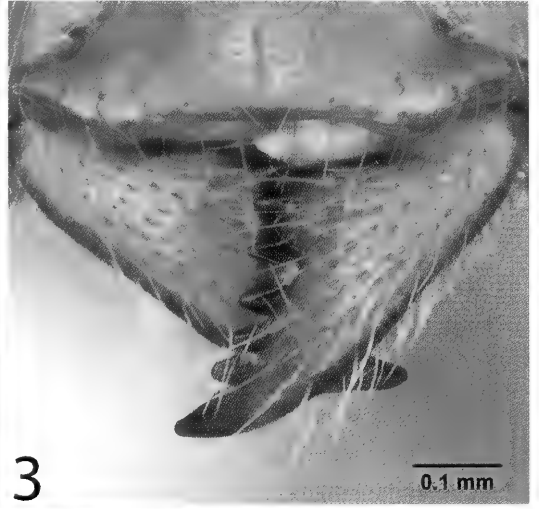
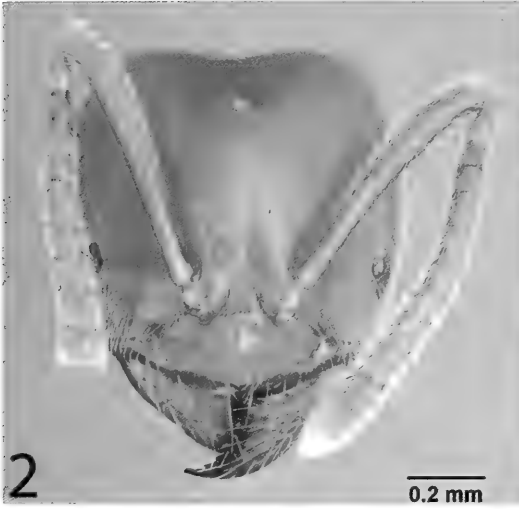
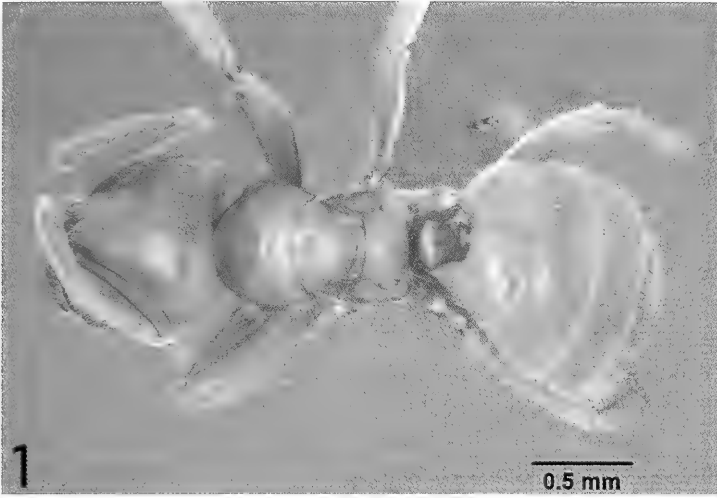
Figures 1–4.

HOLOTYPE WORKER.— GABON: Province Woleu-Ntem, 31.3 km 108° ESE Minvoul, 2°04.8'N, 12°24.4'E, elev. 600 m 11.ii.1998, sifted leaf litter, rainforest (coll. B.L. Fisher) collection code: BLF01684, specimen code: CASENT0104123 (CASC)

DIAGNOSIS.— 8-toothed mandible; mandibular apical tooth about twice as long as other teeth; median ocellus present; total length > 3 mm.

DESCRIPTION.— WORKER: Overall appearance similar to *Acropyga arnoldi* and *A. silvestrii*, see LaPolla (2004) for details of these two species. Head (see Fig. 2): reddish-yellow; head slightly longer than wide; covered in a thick layer of appressed hairs, with short erect hairs along posterior margin; posterior margin slightly concave medially; median ocellus present; eyes relatively large for an *Acropyga* (ca. 10 facets) and placed at lower ¼ of head; 11-segmented, incassate antennae; scape surpasses posterior margin by about half length of pedicel; scape with thick layer of appressed hairs, scattered erect hairs throughout; clypeus slightly convex medially; mandible

FIGURES 1–4 (right). *Acropyga bakwele*, sp. nov. 1) lateral view; 2) head in full-frontal view; 3) mandible in full frontal view; 4) dorsal view.



broad, with six distinct teeth; mandibular basal angle distinct, but not forming seventh tooth; apical tooth twice as long as other teeth (Fig. 3). Mesosoma (see Figs. 1, 4): reddish-yellow; in lateral view, pronotum with short anterior shelf; dorsum covered in layer of appressed hairs, with scattered erect to suberect hairs throughout; metanotal area distinct; propodeum rounded; declivity steep. Gaster: petiole thick and erect, with erect hairs; gaster reddish-yellow, with thick layer of appressed hairs and scattered erect to suberect hairs throughout.

QUEEN.— Unknown.

MALE.— Unknown.

ETYMOLOGY.— The species epithet, *bakwele*, is in honor of the Bakwele pygmies who assisted BLF during his fieldwork in Gabon.

MEASUREMENTS.— (Holotype worker) TL: 3.24; HL: 0.902; HW: 0.870; SL: 0.751; ML: 1.069; GL: 1.272; CI: 96.45; SI: 86.32.

DISCUSSION.— This new *Acropyga* species is not only the largest species presently known from Africa, but it is also one of the largest in the world. Only four other species are known to exceed 3 mm in total length (all are Old World): *A. acutiventris*, *A. butteli*, and *A. myops* all have been observed to exceed 3 mm in total length, whereas *A. rubescens* has been observed over 5 mm in total length.

The most remarkable attribute of *A. bakwele* is the presence of a median ocellus. In the extensive review of *Acropyga* by LaPolla (2004), ocelli were never observed on workers (they are present in queens and males). Unfortunately, with only a single specimen of *A. bakwele* available for study it is impossible to know if the presence of a median ocellus is typical for this species or if the specimen is simply an aberrant worker. Nonetheless, its presence is intriguing and the collection of a nest series will hopefully clarify the point.

Nothing is known about the natural history of this *Acropyga*, except that was collected from sifted leaf litter (a method that commonly collects *Acropyga*) in moist, sandy soil rainforest, near an extensive network of marshland. Where the natural history is known, *Acropyga* are found to nest close to soil in leaf litter, rotting logs, and under stones. They form large colonies with thousands of workers, and some species are possibly polygynous.

The relationship of *A. bakwele* to other species is uncertain, but superficially all African species and *A. paleartica* (known only from Greece) appear closely related. Pending the discovery of *A. bakwele* males, the species remains unplaced in a species-group. The holotype worker resembles *A. arnoldi* in many respects. However, *A. bakwele* is significantly larger than *A. arnoldi*, possesses a longer mandibular apical tooth, and has erect hairs scattered throughout the mesosomal dorsum. One interesting characteristic of *A. bakwele* is that, like *A. arnoldi* and *A. paleartica*, it possesses a 5:4 palpal formula, a characteristic that may be associated with more basal *Acropyga*. In fact, LaPolla (2004) hypothesized that *A. arnoldi* represented that most basal extant species. All African *Acropyga* have worker morphologies that suggest a more basal placement. The mandible in all species can possess over six teeth, with *A. arnoldi* known to possess up to nine teeth. *A. silvestrii* is known to possess up to seven teeth, although some specimens have been recorded with as few as four.

Key to Afrotropical *Acropyga* species (workers)

The following key is modified from LaPolla (2004)

1. Head width < 0.55 mm *A. silvestrii*
 Head width > 0.55 mm 2
2. Head width < 0.7 mm; total length < 3 mm; erect hairs concentrated on the posterior pronotum; median ocellus absent; southern Africa. *A. arnoldi*
 Head width > 0.7 mm; total length > 3 mm; erect hairs scattered throughout dorsum; median ocellus present; West Africa. *A. bakwele*, sp. nov.

ACKNOWLEDGMENTS

Funding for the BLF's field research was provided by WWF-US. Travel for JSL to California was provided by the Smithsonian Institution's Office of Sponsored Research and National Science Foundation under Grant No. INT 9998672 to BLF. We thank April Nobile for creating the images. We thank Wojciech Pulowski and Donat Agosti for their reviews of the paper.

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New and Reconsidered Mexican Acanthaceae XI: *Justicia* in the Yucatan Peninsula

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Two new species (*Justicia edgarcabrerae* and *J. luzmariae*) and a new combination (*J. leucothamna* based on *Jacobinia leucothamna* Standl.) are proposed for the acanthaceous flora of the Yucatan Peninsula. Distribution maps, images of pollen, and illustrations/photos are presented for all three species. Studies of Acanthaceae in the three states (Campeche, Quintana Roo, and Yucatán) composing the Mexican portion of the Yucatan Peninsula reveal the presence of at least 38 native species of Acanthaceae there. Five of the 13 species of *Justicia* there are endemic to these states.

RESUMEN

Dos especies nuevas (*Justicia edgarcabrerae* y *J. luzmariae*) y una combinación nueva (*J. leucothamna* basado en *Jacobinia leucothamna* Standl.) se proponen para la flora de acantáceas de la Península de Yucatán. Se presentan mapas de las distribuciones, imágenes de polen, e ilustraciones/fotos para cada especie. Estudios de las Acanthaceae en los tres estados (Campeche, Quintana Roo y Yucatán) que comprenden la porción mexicana de la Península de Yucatán revelan la presencia por lo menos de 38 especies nativas de Acanthaceae allí. Cinco de las 13 especies de *Justicia* que crecen allí son endémicos a estos estados.

Leonard (1936) treated 59 native species in the plant family Acanthaceae from the Yucatan Peninsula of southern Mexico and northern Central America. Twenty-seven of these were reported from the three states (Campeche, Quintana Roo, and Yucatán) that compose the Mexican portion of the peninsula. Recent studies (Daniel, unpublished and this study) reveal the presence of 38 native species of Acanthaceae in these three Mexican states. Nine of them (24 percent) are endemic there. Although the acanthaceous flora of the Mexican portion of the Yucatan Peninsula is not especially rich in species, the level of endemism there at that taxonomic rank is significantly greater than that noted for several other regions of Mexico, including: Chiapas with 13 percent (Daniel 2005a), “El Bajío” with 5 percent (Daniel and Acosta 2003), Sonora with 3 percent (Daniel 2004), and the Tehuacán-Cuicatlán Valley with 14 percent (Daniel 1999). However, it is nearly equal to the 26 percent endemism reported by Daniel (1997) for species of Acanthaceae in the peninsula of Baja California, another very dry region that is not rich in species. The level of endemism for the Acanthaceae in the Mexican portion of the Yucatan Peninsula is also high compared to the estimated 8.2 percent endemism for the total vascular flora of this region (Carnevali et al. 2003).

Justicia is the largest genus of Acanthaceae with more than 700 species recognized worldwide. It is also the largest genus of Acanthaceae in the Mexican portion of the Yucatan Peninsula with at least 13 species native there. Two of these species from the Yucatan Peninsula are newly described below and a combination is made in *Justicia* for the species previously known as *Jacobinia leucothamna* Standl. Five species of *Justicia* (*J. cobensis* Lundell, *J. dendropila* T.F. Daniel, *J. edgarcabreræ*, *J. leucothamna*, and *J. lundellii* Leonard) are endemic to one or more of the three states composing the Mexican portion of the Yucatan Peninsula. Another one, *J. luzmariae*, is known only from this region and adjacent northern Belize.

Ongoing studies toward a comprehensive taxonomic account of the Acanthaceae of the Mexican portion of the Yucatan Peninsula (Daniel, in progress), including field and herbarium research since 2002, have identified undescribed species (Daniel 2003) and new distribution records (Carnevali et al. 2005; Daniel 2005b) for the family. Additional discoveries and a taxonomic renovation are provided herein.

***Justicia luzmariae* T.F. Daniel, Carnevali, and Tapia, sp. nov.**

Fig. 1.

TYPE.— MEXICO: **Quintana Roo:** Mpio. Lázaro Cárdenas, along hwy. between Kantunilkín and Chiquilá, 7 km S of Chiquilá, 21°22.7'N, 87°22.3'W, 10 m. disturbed evergreen seasonal forest, 25 February 2003, T. Daniel, G. Carnevali, & J.L. Tapia Muñoz 10315 (holotype: MEXU!; isotypes: BR!, CAS!, CICY!, CIQR!, ENCB!, F!, GH!, K!, MICH!, MO!, NY!, TEX!, UCAM!, US!).

Frutices usque ad 5 m longi vel alti. Folia petiolata, laminae (ovato-ellipticae vel) ellipticae vel subcirculares, 21–90 mm longae, 12–63 mm latae, 1.0–2.6-plo longiores quam latiores. Inflorescentia floribus in spicis vel paniculis spicarum. Bracteae obovatae vel obovato-ellipticae, 3–9 (–14) mm longae, 1–5 (–7) mm latae. Calyx 5-lobus, 6–11 mm longus, lobis homomorphis. Corolla viridi-alba vel viridi-lutea et intus maculata. 12–23 mm longa, extus pubescens trichomatibus eglandulosis. Stamina thecis 1.4–2 mm longis, impariter insertis, pubescentibus, basi calcaratis; pollinis granae 3-aperturatae. Capsula 8.5–14 mm longa, glabra.

Clambering (sometimes appearing vinelike) shrubs to 5 m long or tall. Young stems subquadrate to quadrate, bifariously pubescent with retrorse eglandular trichomes 0.1–0.4 mm long. Leaves petiolate, petioles to 25 mm long, blades subcoriaceous, somewhat discolored (lighter green abaxially than adaxially), (ovate-elliptic to) elliptic to broadly elliptic to subcircular, 21–90 mm long, 12–63 mm wide, 1.0–2.6 times longer than wide, rounded to acute to subcordate and often asymmetric at base, rounded to acute at apex, surfaces and margin glabrous (or with a few eglandular trichomes along midvein on adaxial surface), margin entire, sometimes ± revolute. Inflorescence of axillary and/or terminal sessile or pedunculate dichasiate spikes or panicles of dichasiate spikes to 132 mm long (including peduncle, if present), axillary spikes (or panicles of spikes) (alternate to) opposite, 1 per axil, fertile portion of spikes 7–14 mm in diameter near midpoint (excluding flowers), peduncles of spikes to 47 mm long, pubescent like young stems, rachis bifariously pubescent with flexuose to retrorse to antrorse eglandular trichomes 0.2–0.5 mm long, inflorescence bracts (i.e., when panicles of spikes present) subulate to elliptic, 2–5 mm long, 1–2 mm wide; dichasia opposite, 1 per axil, 1-flowered, sessile. Bracts obdeltate to obovate to obovate-elliptic, 3–9 (–14) mm long, 1–5 (–7) mm wide, apically (rounded to) truncate to emarginate, abaxial surface sparsely pubescent with antrorse to antrorsely appressed eglandular trichomes 0.1–0.3 mm long (trichomes mostly or entirely restricted to midvein), margin ciliate with flexuose to antrorse eglandular trichomes. Bracteoles linear to linear-elliptic to lunate to lanceolate (sometimes



FIGURE 1. *Justicia luzmariae*. a. Habit (Crane 509), $\times 0.5$. b. Inflorescence (Gómez-Pompa 1352), $\times 3$. c. Distal portion of stamen with anther (Gómez-Pompa 1352), $\times 13$. d. Distal portion of style with stigma (Gómez-Pompa 1352), $\times 23$. e. Capsule (Crane 509), $\times 5$, opening capsule (top) and inner side of a single valve (bottom). Drawn by Meg Stalcup.

asymmetric), 2.5–7 mm long, 1–2 mm wide, abaxial surface pubescent like bracts. Flowers sessile. Calyx 5-lobed, 6–11 mm long, lobes homomorphic, lanceolate, 5–10 mm long, 1–2 mm wide, abaxially glabrous or with a few trichomes like those on bracts. Corolla greenish externally, greenish white to greenish yellow internally and with maroon markings on both lips (or with the lower lip sometimes light to dark maroon with yellowish green markings), 12–23 mm long, externally pubescent with erect to flexuose eglandular trichomes 0.2–0.5 mm long, tube \pm abruptly expanded

in proximal $\frac{1}{3}$ to \pm gradually expanded distally, 5.5–10 mm long, 3.5–5 mm in diameter near midpoint, internally densely pubescent near base of stamens, upper lip 6–12 mm long, 2-lobed at apex, lobes to 0.5 mm long, lower lip 6–14 mm long, lobes rounded, 1–3 mm long, 1.3–2 mm wide. Stamens inserted between base and midpoint of corolla tube, 8–17 mm long, filaments glabrous, thecae greenish turning maroon, parallel to subparallel, 1.4–2 mm long (including basal appendage), equal to subequal, unequally inserted (overlapping by 0.5–1.2 mm), both dorsally pubescent with flexuose eglandular trichomes, both with blunt basal appendages 0.3–0.7 mm long (appendage of lower theca larger than that of upper theca); pollen (Fig. 2) 3-aperturate, apertures flanked on each side by 1 row of insulae, exine reticulate. Style 7–19 mm long, proximally pubescent with eglandular trichomes, becoming glabrous distally, stigma 0.1–0.2 mm long, asymmetric, lobes sometimes inconspicuous. Capsule 8.5–14 mm long, glabrous, stipe 2.5–4 mm long, head ellipsoid to obovoid, 6–10 mm long. Seeds 4, plano-convex, 3.2–3.5 mm long, 2.2–2.3 mm wide, surfaces smooth (micropapillate), lacking trichomes.

PHENOLOGY.— Flowering: January–March; fruiting: February–April.

DISTRIBUTION AND HABITAT.— Yucatan Peninsula of Mexico (Campeche, Quintana Roo) and northern Belize (Corozal): plants occur in evergreen seasonal forests (“selva mediana subperennifolia”) and tropical subdeciduous forests (“selva baja subcaducifolia”) at elevations of 10–301 m.

PARATYPES.— MEXICO: **Campeche:** Mpio. Calakmul, 3 km E del poblado La Lucha, 18°26'N, 89°25'W, *D. Alvarez & C. Jiménez J. 4205* (CAS); Mpio. Calakmul, 3 km E del poblado Chichonal, carretera Xpujil–Escárcega, 18°31'N, 89°32'W, *D. Alvarez & C. Jiménez J. 4238* (CAS); Mpio. Calakmul, 4.2 km N del poblado La Nueva Vida, 18°50'N, 89°22'W, *D. Alvarez & C. Jiménez J. 4369* (CAS); Mpio. Calakmul, Puente Papagayo, 25 km N de Xpujil, 18°44'N, 89°24'W, *J. Calónico S. et al. 21795* (CAS); Mpio. Hopelchén, S de Xpujil rumbo a la frontera, 18°09.5'N, 89°27.5'W, *C. Chan 4572* (CICY, GH, MO, UCAM); 30 km de Sohlaguna, *A. Gómez-Pompa 1352* (CAS, CICY). **Quintana Roo:** Mpio. Carrillo Puerto, 6–10 km NE de Felipe Carrillo Puerto, camino a Vigía Chico, *E. Cabrera et al. 16373* (CAS); 7–8 km S de Chiquilá, a lo largo de la carretera Chiquilá–Kantunilkin, ca. 21°22'42"N, 87°22'18"W, *G. Carnevali et al. 6733* (CAS, CICY, HUH, MEXU, MO, NY, UCAM, UJAT, US, XAL); Mpio. Felipe Carrillo Puerto on road to Vigía Chico, 19°35.9'N, 88°00.3'W, *T. Daniel 10298* (BR, CAS, CICY, CIQR, K, MEXU, MO, NY, US); Mpio. Lázaro Cárdenas, 6 km ENE of San Angel along road (departs Kantunilkin–Chiquilá hwy, 30 km S of Chiquilá) to E. Zapata, 21°14.2'N, 87°23.2'W, *T. Daniel et al. 10316*

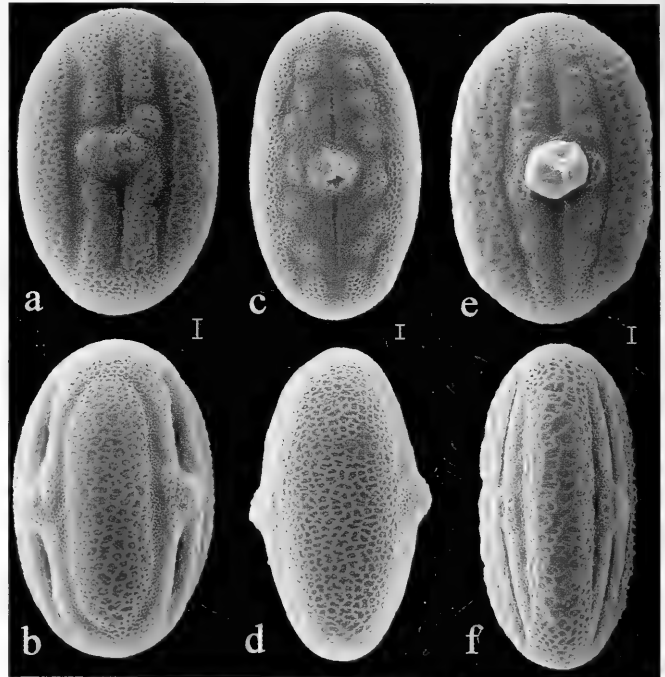


FIGURE 2. Scanning electron micrographs of pollen. a,b. *Justicia edgarcabreanae* (Cabrera & Durán 624), apertural view (a) and interapertural view (b). c,d. *Justicia leucothamna* (Leal & Rico-Gray III), apertural view (c) and interapertural view (d). e. *Justicia luzmariae* (Cabrera et al. 16373), apertural view. f. *Justicia luzmariae* (Gómez-Pompa 1352), interapertural view. All scales = 2 μ m.

(BR, CAS, CICY, K, MEXU). BELIZE: **Corozal**: Cerros Maya Ruins, Lowrey's Bight, *C. Crane 509* (BRIT, LL).

Vegetatively, *Justicia luzmariae* appears superficially similar to (and has occasionally been identified as) *Bravaisia berlandieriana* (Nees) T.F. Daniel. Putative relatives of this species are not obvious among known species of *Justicia* from Mexico and Central America, nor does it conform to any of the sections of the genus recognized by Graham (1988). Among other species of *Justicia* occurring in the Yucatan Peninsula, *J. luzmariae* resembles *J. lundellii* in the shared characters of densely bracteate spike-like inflorescences with prominent bracts, equally 5-lobed calyces, dorsally pubescent thecae, and 3-aperturate pollen. In the latter species, however, the calyx is 2.5–3 mm long, the corolla is 7–9 mm long, the pollen is pseudocolpate (lacking insulae), the capsule is pubescent, and the seeds are bacculate.

The species appears to be widespread in eastern and southern regions of Yucatan Peninsula

(Fig. 3); it has yet to be collected in the state of Yucatán. Within *J. luzmariae*, plants from northern Quintana Roo (*Carnevali et al. 6733*, *Daniel et al. 10315*, and *Daniel et al. 10316*; Fig. 4) differ from those from central Quintana Roo, southern Campeche, and Belize (all other collections cited; Fig. 1) by their longer corollas (17–23 mm vs. 12–14 mm), stamens (14–17 mm vs. 8–9 mm), and styles (17–19 mm vs. 7–12 mm). Variation in coloration of corollas is also evident in the two populations from northern Quintana Roo. There, the internal surface of the lower

lip varies from greenish yellow with maroon markings to light or dark maroon with greenish yellow markings (Fig. 4). The difference in floral length suggests that plants have different pollinators in the two regions. In all other features, plants from northern Quintana Roo appear identical to those from southern Quintana Roo and Campeche.

The epithet of this species honors Dra. Luz María Calvo Irabién, community ecologist at the Centro de Investigación Científica de Yucatán, whose studies and photographs of plants from near Kantunilkín led us to this species.

***Justicia edgarcabreræ* T.F. Daniel, Carnevali, and Tapia, sp. nov.**

Fig. 5

TYPE.— MEXICO: **Quintana Roo**: brecha a Santa Cruz, 1 km S de Pedro A. Santos, 9 Dec 1980, *E. Cabrera & G. Durán 624* (holotype: CAS!; isotype: MEXU!).

Herbæ perennes usque ad 1 m altae. Folia petiolata, laminae ovatae, 13–44 mm longae, 6.5–21 mm latae, 1.5–2.3-plo longiores quam latiores. Spicae axillares. Bracteae spathulatae vel late ellipticae vel subcirculares vel subdeltatae, (5–) 6–9 mm longae, (1–) 2–6.5 mm latae. Calyx 5-lobus, 3.5–5 mm longus, lobis homomorphis. Corolla luteola, 8.3–11.3 mm longa, extus pubes-

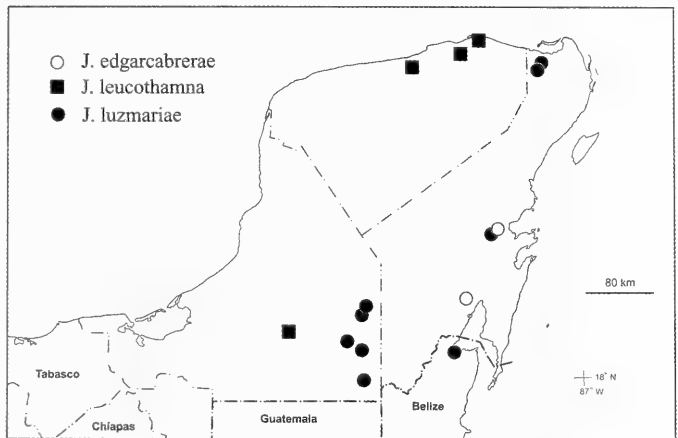


FIGURE 3. Map of the Mexican portion of the Yucatan Peninsula (with states, clockwise from left: Campeche, Yucatán, and Quintana Roo), showing distributions of *Justicia edgarcabreræ*, *J. leucothamna*, and *J. luzmariae*.



FIGURE 4. Photographs of *Justicia lucmariae* (a, b) and *J. leucothamma* (c). a. Carnevali *et al.* 6733, $\times 1.8$. b. Daniel *et al.* 10316 (maroon form), $\times 1.3$. c. Tapia & Cházaro 1453, $\times 2.5$.

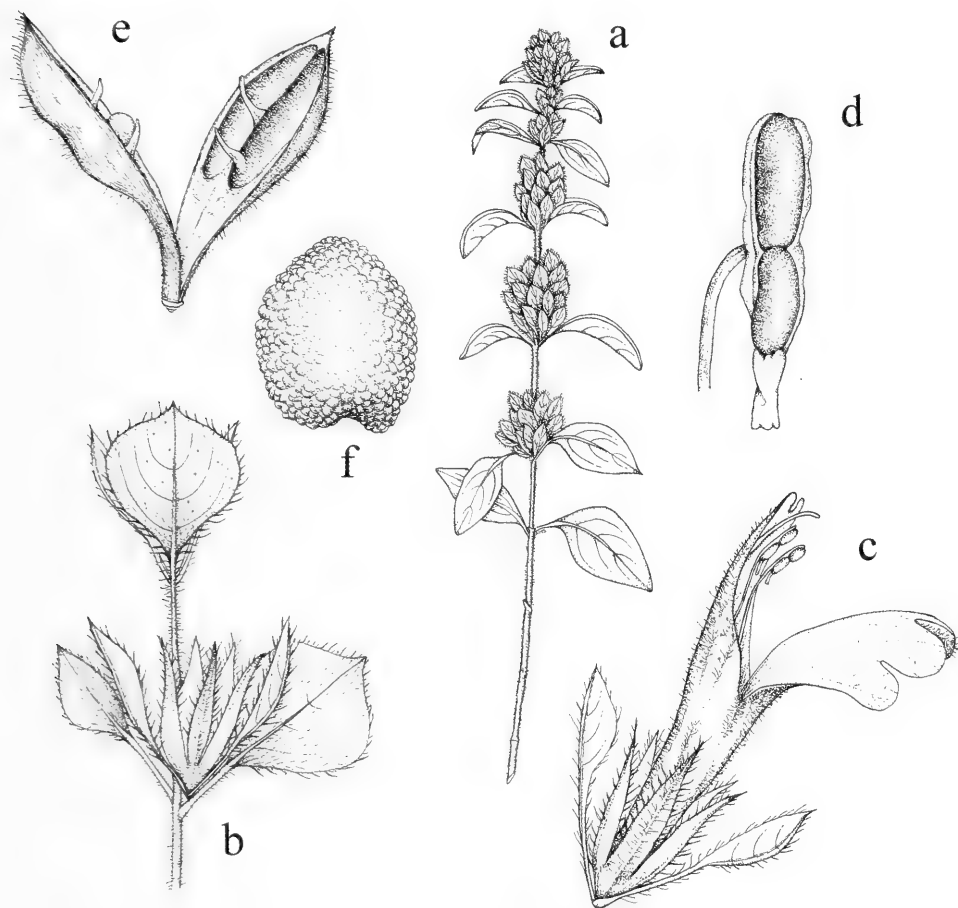


FIGURE 5. *Justicia edgarcabrerae*. a. Habit (Cabrera & Durán 624), $\times 0.4$. b. Inflorescence nodes (Cabrera & Durán 624), $\times 4.8$. c. Dichasium (Cabrera 16968 and Cabrera & Durán 624), $\times 5.8$. d. Distal portion of stamen with anther (Cabrera & Durán 624), $\times 17.3$. e. Capsule (Cabrera & Durán 624), $\times 7.2$. f. Seed (Salazar C. 26), $\times 22.6$. Drawn by Nadia Strasser.

cens trichomatibus glandulosis et eglandulosis. Stamina thecis 1.1–1.4 mm longis, impariter insertis, theca supra pubescens trichomatibus eglandulosis, theca infera basi calcarata; pollinis granae 3-aperturatae. Capsula 5.5–6.5 mm longa, pubescens trichomatibus eglandulosis.

Perennial herbs to 1 m tall. Young stems subquadrate, pubescent with erect to flexuose eglandular trichomes 0.5–1.2 mm long, trichomes disposed throughout but \pm concentrated in 2 lines. Leaves petiolate, petioles to 8 mm long, blades ovate, 13–44 mm long, 6.5–21 mm wide, 1.5–2.3 times longer than wide, (rounded to) acute at apex, acute to subattenuate at base, surfaces pubescent with erect to flexuose to antrorse eglandular trichomes, margin entire. Inflorescence of axillary (and terminal) pedunculate dichasiate spikes to 53 mm long (including peduncles and excluding flowers), 10–11 mm in diameter near midspike, spikes opposite at nodes, 1–2 per axil, borne on peduncles to 5 mm long, rachis \pm evenly pubescent with erect to flexuose to antrorse eglandular trichomes 0.3–0.8 mm long; dichasia alternate, sessile, 1-flowered. Bracts opposite to subopposite, spatulate to broadly-elliptic or subcircular or subdeltate and stalked at base, (5–) 6–9 mm long, (1–) 2–6.5 mm wide, fertile bracts somewhat larger than to conspicuously larger than sterile bracts

(i.e., bracts subheteromorphic to heteromorphic), rounded to acute at apex, abaxial surface pubescent with erect to flexuose eglandular and glandular trichomes 0.2–0.5 mm long, margin ciliate with trichomes like those of abaxial surface and with eglandular trichomes to 1.3 mm long as well. Bracteoles oblanceolate (often asymmetric) to linear, 4–7 mm long, 0.2–1.4 mm wide, pubescent like bracts. Flowers sessile. Calyx 5-lobed, 3.5–5 mm long, lobes equal, 2.5–4.5 mm long, 0.7–0.9 mm wide, abaxially and marginally pubescent with erect to flexuose eglandular trichomes 0.5–1 mm long. Corolla yellowish, 8.3–11.3 mm long, externally pubescent with erect to flexuose eglandular and glandular (sparse) trichomes 0.1–0.5 mm long, tube 4.2–5.5 mm long (not or scarcely expanded distally), 1.5–2.3 mm in diameter near midpoint, upper lip 4–5.3 mm long, apically 2-lobed, lobes 0.3–0.5 mm long, lower lip 4.5–6.5 mm long, lobes 1.2–2.5 mm long, 0.8–2.5 mm wide. Stamens 4.5–5 mm long, inserted near apex of corolla tube, thecae maroon, 1.1–1.4 mm long (including basal appendage), parallel, unequally inserted (overlapping by 0.2–0.3 mm), dorsally pubescent with eglandular trichomes, upper theca with a \pm inconspicuous basal appendage to 0.2 mm long, lower theca with a blunt basal appendage 0.5–0.9 mm long; pollen (Fig. 2) 3-aperturate, apertures flanked on each side by 1 row of insulae or insulae absent and grains 6-pseudocolpate, exine reticulate. Style 7.5–8.5 mm long, proximally pubescent with eglandular trichomes, stigma 0.2 mm long, lobes not evident. Capsule 5.5–6.5 mm long, pubescent with erect to retrorse eglandular trichomes 0.1–0.4 mm long, stipe 1.9–2.5 mm long, head ellipsoid with slight medial constriction. Seeds (immature?) 4, plano-convex, 1.1 mm long, 1 mm wide, surfaces tuberculate.

PHENOLOGY.— Flowering: November–January; fruiting: November–January.

DISTRIBUTION AND HABITAT.— Yucatan Peninsula of Mexico (Quintana Roo; Fig. 3); plants occur in evergreen seasonal forests (“selva mediana subperennifolia”) at elevations from near sea level to 10 m.

PARATYPES.— MEXICO: **Quintana Roo:** Mpio. Felipe Carrillo Puerto, 19 km NW [NE] de F. Carrillo Puerto sobre el camino a Vigía Chico, *E. Cabrera 16968* (CIQR); Mpio. Felipe Carrillo Puerto, KM 20 carr. antigua de F. Carrillo Puerto a Vigía Chico, *Salazar C. 26* (CIQR).

The three known collections of this species each note a different color for the corolla (yellow for the type, blue for *Cabrera 16968*, and white for *Salazar C. 26*). It is possible that each characterization is at least partially correct, and like several other species of *Justicia* in the region, the corollas are cream to yellowish with bluish or purplish markings.

Among species of *Justicia*, *J. edgarcabreræ* appears related to a suite of heteromorphically bracteate American species that includes *J. chol* T.F. Daniel, *J. costaricana* Leonard, *J. nevlingii* Wassh. & T.F. Daniel, and *J. uxpanapensis* T.F. Daniel (Daniel 2002; Wasshausen and Daniel 1995). Among these species pollen varies from 2-aperturate (e.g., *J. uxpanapensis*) to 3-aperturate (e.g., *J. chol*) to 4-aperturate (e.g., *J. nevlingii*). *Justicia edgarcabreræ* is especially similar to *J. chol* which occurs in wetter forests of southern Mexico and has corollas that are white to cream-yellow with maroon markings (Daniel 1995). It differs from that species by the characters noted in the following couplet:

- 1a. Young stems quadrate to quadrate-sulcate; cauline trichomes with maroon septa; leaves with petioles to 35 mm long, blades acuminate at apex; calyx 2.5–3.5 mm long; corolla tube 5.5–7 mm long; stamens 3.5–4.5 mm long, thecae superposed (separated by a gap up to 0.5 mm long); rainforests of Chiapas and Tabasco *J. chol*
 1b. Young stems subquadrate; cauline trichomes without maroon septa; leaves with petioles to 8 mm long, blades (rounded to) acute at apex; calyx 3.5–5 mm long; corolla tube 4.2–5.5 mm long; stamens 4.5–5 mm long, thecae unequally inserted (overlapping by 0.2–0.3 mm); evergreen seasonal forests of Quintana Roo *J. edgarcabreræ*

The epithet of this species is based on the name of the well known Mexican plant collector, Edgar Cabrera (see biographical information in Sousa S. and Cabrera C. 1983), whose fine specimens have enriched knowledge of the Yucatecan flora. Because of the existence of *J. cabreræ* Leonard, named for a different collector, we use both given and family names in this epithet.

Justicia leucothamna (Standl.) T.F. Daniel, Carnevali, and Tapia, comb. nov.

Jacobinia leucothamna Standl., Field Mus. Nat. Hist., Bot. Ser. 8: 44. 1930.

TYPE.— MEXICO: **Yucatán:** Silam [= Dzilam González, see below], *G. Gaumer 1242* (holotype: F!).

Jacobinia Nees is usually included within *Justicia* (see Graham 1988), and a combination in the latter genus has not previously been made for this species. *Justicia leucothamna* is apparently known only by the six collections from the Yucatan Peninsula listed herein. Thus, it appears to be endemic to the Mexican portion of the Yucatán Peninsula (Fig. 3). The affinities of this species were not addressed by Standley in the protologue or by Leonard (1936) in a treatment of Acanthaceae of the Yucatan Peninsula. In many features (e.g., axillary, secund, and dichasiate spikes; four calyx lobes of equal length; whitish corollas; and contiguous but unequally inserted and dorsally pubescent thecae, the lower with a prominent basal appendage) the species resembles *J. salviiflora* H.B.K. of Graham's (1988) section *Sarotheca* (Nees) Benth. These species differ by the distinctions noted in the following couplet:

- 1a. Leaves to 85 mm long, to 43 mm wide, and 1.2–2.7 times longer than wide, apically acute- to rounded- to truncate-apiculate; calyx 3–5 mm long; corolla white with maroon markings, 9–12 mm long; capsule 8–12 mm long, glabrous *J. leucothamna*
 1b. Leaves to 170 mm long, to 77 mm wide, and 1.5–4.4 times longer than wide, apically acute to acuminate to subfalcate; calyx 5.5–12 mm long; corolla greenish yellow tinged with pink and with maroon markings, 12–21 mm long; capsule 14–20 mm long, pubescent. . . *J. salviiflora*

Both of these species have 2-aperturate pollen with trema regions flanked on each side by one row of peninsulae or insulae (Fig. 2).

Martínez S. et al. 30861 occurs well to the south of other known collections of this species (Fig. 3). It was collected in a moister habitat ("selva mediana subcaducifolia") than the collections from northern Yucatán ("selva baja caducifolia"), and its stems and leaves are not as densely pubescent as in plants from the drier regions. On the basis of recent collections, Standley's (1930) description of *J. leucothamna* can be augmented as follows: corollas white with maroon markings on the lower lip (Fig. 4), 9–12 mm long; stamens 4–6.5 mm long, thecae maroon, 1–1.3 mm long; capsules 8–11.5 mm long, glabrous; seeds 4, 1.8–2.2 mm long, surface and margin densely tuberculate with conical tubercles.

The type locality of this species was cited by Gaumer as "Silam." Among his collections of Acanthaceae, Gaumer distinguished between "Silam" and "Port Silam." In addition, Millspaugh, who worked with Gaumer's collections, distinguished "Silam" from "the port of Silam" (Millspaugh 1896); and on his map of the Peninsula (Millspaugh 1896), "Silam" is shown interior to the coast. This certainly suggests that "Silam" refers to what appears on modern maps as Dzilam González, and that "the port of Silam" would refer to what appears on modern maps as Dzilam de Bravo (which is situated on the coast, ca. 15 km NE of Dzilam González). Thus the type locality would appear to be Dzilam González.

ADDITIONAL SPECIMENS EXAMINED.— MEXICO: **Campeche:** Mpio. Calakmul, 45 km NW de Conhuas, camino a Champotón, 18°49'N, 90°00'W, *E. Martínez S. et al. 30861* (CAS, MEXU). **Yucatán:**

Silam, *G. Gaumer 2280* (F, GH, MO); Mpio. Río Lagartos, pasando el Rancho Paraiso rumbo a Las Coloradas, 21°35'N, 88°10'W, *J. Leal & I. Espejel 223* (CICY); Mpio. San Felipe, 16 km después de Panabá rumbo a San Felipe, 21°26'N, 88°15'W, *J. Leal & V. Rico-Gray 111* (CICY); Mpio. Dzemul, km 6 de la carretera Dzemul-Xtampú, 4 km S del entronque a ruinas de Xtampú, 21°16.5'N, 89°18.5'W, *J.L. Tapia M. & M. Cházaro 1453* (CAS, CICY).

ACKNOWLEDGMENTS

Daniel's field and herbarium studies were funded by a Franklin Grant from the American Philosophical Society in 2003; this award is gratefully acknowledged. We thank Meg Stalcup and Nadia Strasser for their fine botanical illustrations; Scott Serata for assistance with the scanning electron microscope; Lilia Can, Francisco Chi-May, Celso Gutiérrez, Silvia Hernández Aguilar, Gerald Islebe, and Filogonio May for their valuable assistance in the Yucatan Peninsula; and the curators of the following herbaria for access to their collections: BRIT, CAS, CICY, CIQR, F, GH, LL, MEXU, MO, UCAM. We also thank the reviewers for their thoughtful comments.

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***Vanderhorstia bella*, a New Goby from Fiji
(Teleostei: Gobiidae)**

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A single individual of a new goby species in the genus *Vanderhorstia* was collected from a fine sand bottom at Vanua Balavu Island, Bay of Islands, in the Northern Lau Group of Fiji. The species differs from all other described species in the genus except *V. mertensi* by having 17 dorsal and 18 anal-fin rays. It differs from *V. mertensi* by having about 77 versus 52–62 longitudinal scales and lacking a row of black spots the length of its midside. *Vanderhorstia bella* has much lavender coloration on the head and body and many bright yellow spots.

While conducting a survey of the fishes of Fiji, we collected a single individual of a spectacularly colored new goby in the genus *Vanderhorstia*. The specimen was collected using rotenone from a fine, silty, sand bottom at a depth of 8.3 m at Vanua Balavu Island, Bay of Islands, in the Northern Lau Group of Fiji.

The genus *Vanderhorstia* is represented by 12 described species, which are considered to be valid (Winterbottom et al. 2005).

MATERIALS AND METHODS

All counts and measurements follow Winterbottom et al. (2005). Measurements were made to the nearest 0.1 mm using dial calipers and are expressed as percentage of standard length (SL). Dorsal pterygiophore formula and some other counts were taken from a radiograph. Format generally follows Winterbottom et al. (2005) for ease of comparison, and when characters are the same, their description is used. The holotype is deposited at the California Academy of Sciences (CAS).

SPECIES DESCRIPTION

***Vanderhorstia bella* Greenfield and Longenecker, sp. nov.**

Figs. 1–4.

MATERIAL EXAMINED.— Holotype: CAS 222208, 70.9 mm SL, Fiji, Northern Lau Group, Vanua Balavu Island, Bay of Islands, 17°10.692'S, 179°00.887'W, fine, silty, sand with small coral patch, 8.3 m, 7 January 2003, field number G03-22, collected by D.W. Greenfield, K.R. Longenecker, and R.C. Langston.

DIAGNOSIS.— A species in the genus *Vanderhorstia* with 17 segmented dorsal-fin rays, 18 segmented anal-fin rays, about 77 longitudinal scales, and a pointed caudal fin, lacking a row of black spots on its side, and having yellow spots on a lavender background on its head and anterior part of its body.

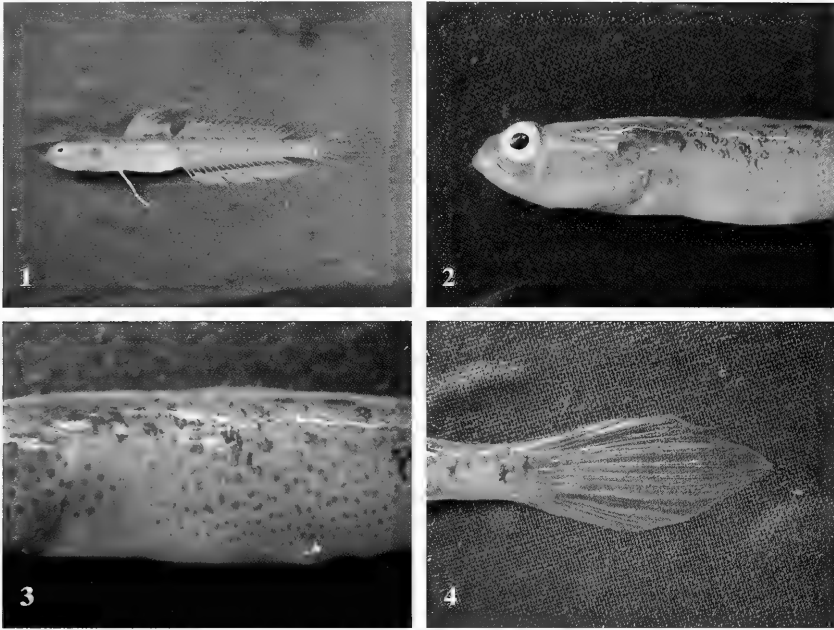
DESCRIPTION.—Dorsal-fin elements VI-I,17, all rays branched; anal-fin elements I,18, all rays branched; pectoral-fin rays 18, upper and lowermost rays unbranched; pelvic-fin elements I,5; segmented caudal-fin rays 17, 9 dorsal + 8 ventral branched rays; dorsal unsegmented (procurrent) caudal-fin rays 7; ventral unsegmented (procurrent) caudal-fin rays 7; longitudinal scales about 77; transverse scale rows from anal-fin origin anterodorsally to first dorsal-fin base 20; transverse scales from anal-fin origin posterodorsally to second dorsal-fin base 17; predorsal scales absent in midline; scales beginning above pectoral-fin base extend posteriorly to insertion of first dorsal fin; circumpeduncular scales 12; no scales on pectoral-fin base; scales on prepelvic region embedded and difficult to count; gill rakers 4 + 16 on outer surface of first arch; vertebrae 10 + 16; dorsal pterygiophore formula 3 (2,2,1,1); epural 1; anal-fin pterygiophores anterior to first haemal spine 2; pleural ribs on third to tenth precaudal vertebrae.

The following measurements are expressed as % SL: head length 25.2; head width 9.4; head depth 13.1; snout length 3.7; eye diameter 5.5; interorbital width 2.0; nape width 7.4; jaw length 11.1; body depth at origin of first dorsal fin 13.1; body depth at origin of anal fin 11.2; body width 7.3; predorsal length 29.1; prepelvic length 27.5; preanal length 51.7; caudal-peduncle length 11.9; caudal-peduncle depth 7.3; length of first dorsal-fin base 19.5; length of second dorsal-fin base 41.8; pectoral-fin length 28.2; pelvic-fin length 24.0; length of first dorsal-fin spine 18.3; length of second dorsal-fin spine 17.5; length of third dorsal-fin spine 16.7; length of fourth dorsal-fin spine 27.1; length of fifth dorsal-fin spine 22.4; length of sixth dorsal-fin spine 16.4; length of spine of second dorsal fin 8.9; length of first segmented ray of second dorsal fin 12.4; length of longest segmented ray of second dorsal fin (= 4th) 13.7; length of anal-fin spine 7.9; length of first segmented ray of anal fin 10.2; length of longest segmented ray of anal fin (= 5th) 15.1; length of pelvic-fin spine 7.1; length of first segmented ray of pelvic fin 11.5; length of fifth segmented ray of pelvic fin 21.6; caudal-fin length 37.1.

Body elongate and compressed. Head slightly compressed, its width 71.7% of depth. Snout very short, its length 67% of eye diameter; snout does not protrude beyond upper lip. Eye dorso-lateral, moderately large, its diameter 22.0% of head length; interorbital space narrow its width narrower than pupil diameter and 8.1% of head length. No distinct, deep trough around eyes from interorbital to postorbital regions. No cutaneous ridge along dorsal midline of nape. Gape moderately oblique, forming an angle of about 28° with body axis. Lower jaw projecting anteriorly beyond upper jaw; posterior end of jaws reach to slightly behind posterior eye margin; jaw length 43.9% of head length.

Anterior nasal opening a short tube, with the posterior edge slightly longer than the anterior edge; posterior nasal opening a large pore, located adjacent to eye. Tip of tongue rounded, anterior portion free from floor of mouth. Posteroventral margin of lower lip entire, no mental flap on chin. Gill opening wide, extending anteriorly to vertical line through posterior margin of pupil of eye; gill membranes attach to very narrow isthmus; no distinct free rear margin. No fleshy projections on lateral wing of shoulder girdle. No bony projections along posterior margin of preopercle.

Caudal peduncle moderately slender, its depth 61.3% of caudal-peduncle length. First dorsal fin higher than second dorsal fin; first dorsal fin close to, but not connected to second dorsal fin by membrane; fourth spine of first dorsal fin longest, 155.4% of second spine length, not filamentous; all dorsal spines slender and flexible; fourth segmented ray of second dorsal fin longest. Origin of anal fin on vertical base with first segmented ray of second dorsal fin; height of anal fin slightly higher than second dorsal fin; anal-fin spine slender and flexible; fifth anal-fin ray longest. Pectoral fin nearly lanceolate, reaching posteriorly to vertical line through base of second dorsal fin between spine and first segmented ray; upper and lowermost pectoral-fin rays unbranched, the remainder branched. Origin of pelvic fin about midway between posterior edge of opercular membrane and



FIGURES 1–4 (CAS 222208); Holotype of *Vanderhorstia bella*. (1) Full lateral view; (2) Closeup of head and anterior portion of body; (3) Closeup of anterior body showing distinctive color markings; (4) Closeup of caudal fin.

dorsal-fin origin; pelvic fins joined medially by well-developed frenum (between spines) and inter-radial membrane (between innermost segmented rays); pelvic frenum moderately thin, with smooth posterior margin; all segmented pelvic-fin rays branched.

Head scaleless, including predorsal; scales cycloid on anterior part of body back to about tips of pectoral fins, becoming larger and ctenoid with peripheral cteni posteriorly; no scales on pectoral-fin base; scales overlying basal region of caudal fin all ctenoid.

Teeth in both jaws unicuspid; upper jaw with outer row of spaced, enlarged, curved caniniform teeth and an inner row of small similar teeth, teeth near symphysis enlarged and point posteriorly; lower jaw with 1–3 enlarged, curved, spaced, caniniform teeth, two irregular rows of smaller teeth medially grading into a single row posteriorly, an innermost row of 2–3 much enlarged curved, spaced canines at bend of dentary; no teeth on vomer or palatine.

Cephalic sensory systems: pore pattern as in *Vanderhorstia nannai* (Winterbottom 2005, Fig. 3). All cephalic sensory-papillae rows uniserial, not forming multiple rows; relatively reduced longitudinal pattern of sensory papillae rows on cheek; row *a* short and reduced, with about four sensory papillae; row *b* very short, extending back from row *a* to about one-third distance to preopercle; row *d* extending back just past end of maxilla.

Color of fresh specimen: Background color white, overlaid by lavender in many areas. Side of head bright, iridescent lavender covered with many small (about one-third pupil diameter) round, bright yellow spots extending from eye back onto pectoral-fin base. Snout and jaws white with a slight lavender tinge. A black line in fold between premaxilla and maxilla anterior to eye. Pupil black, iris silver with tinges of yellow. Lower side of head white, top of head and nape lavender. Sides of body with lavender tinge on upper half (less intense than on head), white on lower half; upper half covered with irregularly-shaped yellow spots edged in black; lower half with smaller yellow spots without black edges; a series of 13 irregular black vertical lines on midside below sec-

ond dorsal fin; a series of 10 dark blotches running from middle of first dorsal-fin base to caudal peduncle. Pectoral and pelvic fins clear. First dorsal fin light yellow. Second dorsal and anal fins light yellow with distal lavender margins. Caudal fin with light yellow rays and lavender membranes in between.

Color in alcohol: Background color cream. Top of snout and anterior portion of premaxilla and maxilla dusky, posterior part of jaws cream, a distinct black line between premaxilla and maxilla, antero-ventral to eye. Side of head and pectoral-fin base with numerous round light spots; pupil of eye black, iris silver with black dorsal margin. Top of head and nape with scattered small brown spots, upper half of body with irregular small light spots surrounded with dark pigment; lower half of body and breast cream. Caudal, anal and pelvic fins peppered with small dark pigment spots; pectoral fins immaculate; first and second dorsal fins peppered with small dark spots and with small round light spots.

ETYMOLOGY.— From the Latin *bellus*, an adjective meaning beautiful, referring to the striking coloration of the species.

COMPARISONS.— *Vanderhorstia bella* is in the subfamily Gobiinae because it has a single anterior pore in the interorbital area, the lower jaw has more than one row of teeth, both the dorsal and anal fins are separate from the caudal fin, and the two dorsal fins are separate. The fish keys to the genus *Vanderhorstia* in Larson and Murdy (2001) because of the following features: 1a. First gill slit open; 2b. Body scaled; 8b. No dermal crest anterior to first dorsal fin; 11b. No barbels on underside of head; 16b. Dorsal-fin spines thin and flexible; 21b and 22b. Preopercle lacking spines; 23b. Dorsal-fin origin behind pectoral-fin base; 24b. Cheeks without prominent vertical fleshy flaps bearing papillae; 25b. Pelvic fins without fleshy frenum folded forward; 30b. Chin without mental frenum; 34b. Head without fine fleshy flaps and bumps; 35b. Head pores present; 39b. Pelvic fins completely connected by membrane; 43b. Mouth not small and vertical; 44b. Cheeks and operculum naked; 48a. Gill opening extending forward to rear margin of eye; 49b. Head papillae in a longitudinal pattern; 50a–50b. There is one more anal than dorsal-fin ray, which would key to *Silhouettea*, but because of its very short snout, pointed caudal fin, approximately 77 longitudinal scales, smooth-edged frenum, and rounded tongue it clearly does not fit the diagnosis of Larson and Miller (1986). Also, other *Vanderhorstia* species have more anal than dorsal-fin rays (e.g., *V. mertensi*), thus the key is in error and 50b. was chosen; 51b. No iris lappet and tongue not deeply bilobed; 52b. Second dorsal fin and anal fin with 1 spine and more than 10 soft rays; 53b. No distinct black ocellus in each dorsal fin; 54b. Caudal fin pointed, longer than head, body with spots, and no bright white spot on pectoral fins = *Vanderhorstia*. As pointed out by Shibukawa and Suzuki (2004), there are no derived characters supporting monophyly of *Vanderhorstia*, and it is separated from *Ctenogobiops* only by caudal-fin length and coloration.

The number of segmented dorsal and anal-fin rays of *V. bella* is high (D. 17, A. 18) compared to all other described species except *V. mertensi* Klausewitz which has 16 dorsal-fin rays and 17–18 anal-fin rays. All other described species have 10–14 dorsal-fin rays and 10–14 anal-fin rays. *Vanderhorstia bella* differs from *V. mertensi* by lacking its distinctive row of black spots that extend down the middle of its sides from the opercle to the caudal peduncle, and by having about 77 versus 52–62 longitudinal scales. Its high longitudinal scale count also separates it from all other species except *V. ambanoro* (Fourmanoir). It also differs in its distinctive coloration from all described and photographs of undescribed species in the literature.

Because the holotype was collected in a general rotenone station, we do not know if it associates with a shrimp or lives in a burrow; however, many other species in the genus *Vanderhorstia* do. The radiograph of the specimen showed that it had one clam and one snail in its stomach, suggesting that it may feed on items brought up by a shrimp.

ACKNOWLEDGMENTS

We would like to thank R.C. Langston for assistance in collecting specimens, and Captain B. Vasconcellos and the crew of the *Moku Moku Hine* for assistance in the field. We are grateful to J. Seeto, G.R. South, R.R. Thaman, and R.W. Tuxton of the University of the South Pacific, Fiji for facilitating our collecting in Fiji. We also thank the Fijian Government and local village chiefs for permission to collect fishes. Special thanks to the staff at CAS for providing assistance: D. Catania, W.N. Eschmeyer, J. Fong, M. Hoang, T. Iwamoto, as well as an anonymous reviewer. This research was supported by National Science Foundation grants INT97-29666 and DEB0-1027545, and Sea Grant Project R/FM-6PD.

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Two New Cardinalfishes of the Indo-Pacific Fish Genus *Zoramia* (Apogonidae)

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Two new species of *Zoramia* (formerly a subgenus of *Apogon*) are described. *Zoramia flebila*, described from Fiji, has blue spots on the sides, blue teardrop-shaped marks under the eyes, and two narrow yellow lines on the midside. It also has a small spot surrounded by diffuse melanophores on the caudal peduncle, and lacks an opercular spot and dark vertical lines above the anal-fin rays. It has scattered melanophores on the breast, pelvic fins, and the entire second dorsal fin, and a line of dark pigment along the anal-fin base. There are 27–30 gill rakers, usually 28 or 29. *Zoramia fragilis*, previously thought to range from the Indian Ocean into the Pacific, was shown to consist of two species; *Z. fragilis* restricted to Mozambique, Madagascar, and the Seychelles, and those in the Pacific Ocean a separate species here described as *Z. viridiventer*. These two species are separated by the number of gill rakers and dorsal and anal-fin spine length.

Fraser (1972) divided the apogonid fish genus *Apogon* Lacepède into ten subgenera, mainly on osteological characters. The subgenera *Pristiapogon* and *Zoramia* Jordan were revised by Fraser and Lachner (1985), who recognized four species within *Zoramia* Jordan: *A. leptacanthus* Bleeker, the type species, wide-ranging from the east coast of Africa to the Samoa Islands; *A. fragilis* Smith with a disjunct population, one from Mozambique (type locality), Madagascar, and the Seychelles, and the other from Indonesia and the Philippines to the Marshall Islands and Samoa Islands; *A. gilberti* (Jordan and Seale) from the Philippines, Sabah, and Indonesia, east to Palau and Yap; and *A. perlitus*, described as a new species from Palau, Papua New Guinea, Molucca Islands, and the Philippines.

Rodman-Bergman (2004) reviewed the generic and subgeneric classification of the Apogonidae. Using external morphology, skeletal characters and a detailed study of the cephalic lateralis system, she concluded that *Apogon* is an unnatural taxon: “Every cladogram generated in these analyses showed that the subgenera of these two taxa (*Apogon* and *Pterapogon*) were more closely related to other genera, than they were to one another.” Based on her findings we are treating the subgenus *Zoramia* of Fraser (1972) as a genus.

While conducting a survey of the fishes of Fiji, we collected individuals of a species of *Zoramia* that we did not recognize. The specimens were similar in color to *Z. gilberti*, but lacked the spot on the opercular flap and have distinctive blue teardrop-like marks on the cheek and blue spots on the side of the body above the pectoral fin. In checking comparative material of other species of *Zoramia*, we discovered that the eastern population identified as *Zoramia fragilis* is a

distinct species. The purpose of this paper is to describe these two new species of cardinalfishes. We present first the diagnosis of *Zoramia* based primarily on Fraser and Lachner (1985), followed by a revised key to the species of the genus and the descriptions of the two new species.

MATERIALS AND METHODS

Data for the holotype are presented first, followed by the range and mean or mode for all specimens in parentheses. Measurements were made to the nearest 0.1 mm using dial calipers and are expressed as percentage of standard length (SL). Methods of making counts and measurements follow Fraser and Lachner (1985), except for body depth, which was taken vertically from below the origin of the dorsal fin (their measurement from the origin of first dorsal spine to the insertion of the pelvic spine is slightly oblique). We also added body width (taken just behind the gill opening), predorsal, preanal, and prepelvic lengths, lengths of dorsal- and anal-fin bases, and caudal concavity, the horizontal distance between the tips of the longest and shortest caudal rays. A microscope is needed to see scattered melanophores described in the key for *Z. flebila*.

The spines and especially the soft rays of the fins of the species of *Zoramia* are very fragile and often found broken. It is unusual to have a specimen with fully intact fins among older lots of museum specimens. Longest caudal-fin ray and caudal concavity measurements of the holotypes were taken from photographs in the field before fin rays were broken. The third dorsal-fin spine is broken in the holotype of *Z. flebila*. Lateral-line scales often are lost. Eye size as percentage standard length versus standard length for *Z. flebila* and *Z. gilberti* was tested with a two-sample T-test (Fig. 3). Specimens used in figure two were from both some of the types and also CAS 2223156. Except for *Z. flebila*, *Z. viridiventer*, and *Z. fragilis*, gill raker counts in Table 2 are from Fraser and Lachner (1985). Measurements for *Z. viridiventer* were taken from nine BPBM specimens. Specimens of the new species have been deposited in the Australian Museum, Sydney (AMS); Natural History Museum, London (BMNH); Bishop Museum, Honolulu (BPBM); California Academy of Sciences, San Francisco (CAS); Field Museum of Natural History, Chicago (FMNH); University of Kansas (KU); National Science Museum, Tokyo (NSMT); South African Institute for Aquatic Biodiversity, Grahamstown (SAIAB); and the U.S. National Museum of Natural History, Washington, D.C. (USNM).

Genus *Zoramia* Jordan, 1917

Zoramia Jordan, 1917: 46 [type species *Apogon graeffi* Günther, 1873, by original description (also monotypic) = *Apogon leptacanthus* Bleeker, 1856].

DIAGNOSIS.— Dorsal rays VI–I,9; anal rays II,9; pectoral rays 13–15 (usually 14); pelvic rays I,5; scales finely ctenoid; lateral line complete to caudal-fin base, the pored scales 23–24; median predorsal scales 6; scales of body not smaller than lateral-line scales; gill rakers 24–32; branchiostegal rays 7; vertebrae 10 + 14; supraneural (predorsal) bones 3; mouth very oblique, the lower jaw strongly projecting; supramaxilla absent; posterior end of maxilla with a distinct notch; maxilla with a longitudinal ridge ending just before angle of posterior notch; jaws with two rows of very small conical teeth anteriorly, narrowing to one row posteriorly; a single row of very small teeth on vomer and palatines, none on ectopterygoids; preopercular ridge smooth, the edge finely serrate, becoming smooth dorsally on posterior limb; infraorbital edge smooth; posttemporal smooth; body depth moderately deep, 2.1–4.0 in standard length (juveniles more slender, in general), and strongly compressed, the maximum width 2.5–3.4 in body depth; caudal fin moderately forked; no black stripes (though there may be a dark line along dorsal edge of body); digestive tract black.

Key to the Species of *Zoramia*

- 1a. No black spot on caudal peduncle; second dorsal spine very long and filamentous, 34–66% SL (at SL of 23 mm or more), the third and fourth spines also prolonged (east coast of Africa to Samoa Islands) *Z. leptacantha* (Fig. 1A)
- 1b. A small black spot midposteriorly on caudal peduncle; second dorsal spine not very long and filamentous (except adults of *Z. flebila* and *Z. gilberti*, but spine length less than 36% SL). 2
- 2a. A prominent to diffuse dark spot posteriorly on opercle; total gill rakers 28–32 (Philippines, Indonesia, and western Caroline Islands) *Z. gilberti* (Fig. 1B)
- 2b. No dark spot posteriorly on opercle; total gill rakers 24–30. 3
- 3a. Four to eight short vertical dark lines above anterior half of anal-fin (Philippines, Indonesia, Papua New Guinea, and Palau). *Z. perlita* (Fig. 1F)
- 3b. No vertical dark lines above anal-fin base. 4
- 4a. Basicaudal black spot surrounded by a dusky to blackish zone; entire second dorsal fin, breast, and pelvic fins with scattered melanophores (microscope needed); a line of melanophores running along anal-fin base on body; second dorsal-fin spine 21.8–35.2% SL; body depth usually greater than 40% SL (Fiji) *Z. flebila*, sp. nov. (Fig. 1C, 2)
- 4b. Basicaudal black spot not within a dusky to blackish zone on caudal peduncle; posterior half of second dorsal fin, breast, and pelvic fins lacking scattered melanophores; no line of melanophores running along anal-fin base on body; second dorsal-fin spine 18.9–24.8% SL; body depth usually less than 40% SL 5
- 5a. Gill rakers 27–30; second dorsal-fin spine 21.5–24.8% SL; second anal-fin spine 15.1–17.9% SL (Mozambique, Madagascar, and Seychelles). *Z. fragilis* (Fig. 1D)
- 5b. Gill rakers 24–27; second dorsal-fin spine 18.9–21.7% SL; second anal-fin spine 13.0–15.9% SL (Philippines to Queensland, east to Marshall Islands and Samoa Islands) *Z. viridiventer*, sp. nov. (Fig. 1E, 4–6)

SPECIES DESCRIPTIONS

Zoramia flebila Greenfield, Langston, and Randall, sp. nov.

Figs. 1C, 2, Tables 1–2.

MATERIAL EXAMINED.—**HOLOTYPE:** CAS 222057, 40.2 mm SL, Fiji, Northern Lau Group, Vanua Balavul Island, Bay of Islands, 17°10.692'S, 179°00.887'W, sand with small coral patch, 8.3 m, 7 January 2003, field number G03-22, collected by D. W. Greenfield, K. R. Longenecker, and R. C. Langston. **PARATYPES:** BPBM 40152, 38.4 mm SL, collected with holotype; USNM 383148, 35.1 mm SL, collected with holotype; CAS 222155, 34.6–39.5 mm (3), Fiji, Vanua Levu, north shore, Great Sea Reef, southwest of Kia Island, 16°18.591'S, 179°02.129'E, isolated coral head in fine sand, 10.8–11.5m, 27 March 2002, field number G02-109, collected by D. W. Greenfield, K.R. Longenecker, R. C. Langston, and B. K. Mataitini; FMNH 116455, 43.6 mm, collected with CAS 222155; BM(NH) 2005.4.25.1, 39.3 mm, collected with CAS 222155; AMS I.43576-001, 36.4 mm, collected with CAS 222155; NSMT-P70721, 41.5 mm, collected with CAS 222155; SAIAB 75633, 36.1 mm, collected with CAS 222155; BPBM 40153, 33.3 mm, collected with CAS 222155; USNM 383149, 40.4 mm, collected with CAS 222155. **ADDITIONAL MATERIAL EXAMINED:** *Zoramia flebila*, CAS 222156 (112), CAS 219847 (1 –DNA = 4024), KU 31970 (1–DNA = 4020), all collected with paratypes CAS 222155. *Zoramia gilberti*: Western Caroline Islands, Yap Island, CAS 83496 (50), CAS 28780 (40), CAS 28780 (1), Palau, CAS 85911 (4). *Zoramia viridiventer*: Solomon Islands, CAS 167414 (9). *Zoramia leptacantha*: Yap Island, CAS 84415 (2), Palau, CAS 84399 (2), Fiji, CAS 222157 (39). *Zoramia*

perlita: Palau, CAS 30740 (5) paratypes, CAS 30745 (1) paratype. *Zoramis fragilis*: Madagascar, USNM 211839 (9).

DIGANOSIS.— A species in the genus *Zoramia* with no distinct dark line on the dorsum from the first dorsal-fin origin onto the caudal peduncle; no dark lines above insertion of anal-fin rays; opercular flap lacking a prominent or diffuse dark spot; caudal spot small, surrounded with many diffuse melanophores on caudal peduncle; a peppering of melanophores on the breast and pelvic fins, and all of the second dorsal fin; distinct blue teardrop-like marks on cheek; blue spots on side above pectoral fin; two narrow yellow lines on midside; an iridescent blue line along anal-fin base; total developed gill rakers 27–30, usually 28 or 29; second dorsal-fin spine 21.8–35.2 % SL; body depth 39.7–47.2% SL.

DESCRIPTION.— Dorsal-fin elements VI–I, 9; anal-fin elements II, 9 last dorsal and anal-fin rays branched to base; pectoral-fin rays 13 (13–14, usually 14), uppermost two and lower two or three unbranched; pelvic-fin rays I, 5, all branched; principal caudal-fin rays 17, upper and lower unbranched; well-developed gill rakers 21 + 7 (21–23, usually 22 + 6–7, usually 6, total 27–30, usually 28 or 29); pored lateral-line scales 24; transverse scale rows above lateral line 2; median predorsal scales 6; circum-peduncular scales 12.

Proportions (as percent SL; also see Table 1): Body depth 47.2 (39.7–47.2; 44.1); head length 39.7 (38.1–41.8; 40.0); eye length 14.8 (14.4–15.7; 15.2); snout length 9.8 (6.8–9.8; 7.9); bony interorbital width 8.8 (8.4–9.7; 9.2); upper jaw length 18.9 (17.7–20.3; 18.8); caudal-peduncle depth 17.1 (15.4–19.0; 16.8); caudal-peduncle length 23.0 (18.8–28.5; 24.6); predorsal-fin length 37.3 (36.6–41.2; 38.9); base of first dorsal fin 19.0 (14.9–19.0; 17.4); dorsal-spine lengths—first 10.1 (10.1–14.8; 12.4), second 35.2 (21.8–35.2; 27.3), third [broken in holotype, not measured] (19.0–23.2; 21.9), fourth 21.0 (16.6–23.6; 19.7), fifth 15.5 (11.5–15.7; 13.6), sixth 8.1 (6.8–9.2; 8.0); base of second dorsal fin 20.6 (17.4–24.5; 21.6); spine in second dorsal fin 14.9 (14.9–21.1; 18.0); longest dorsal ray 26.6 (26.6–29.2; 28); preanal length 60.1 (55.4–63.9; 60.6); base of anal fin 23.7 (20.3–24.0; 22.4); anal-spine lengths—first 4.8 (4.3–5.8; 4.9), second 13.0 (13.0–16.2; 14.9); longest anal ray broken (25–27.5; 26.5); pectoral-fin length

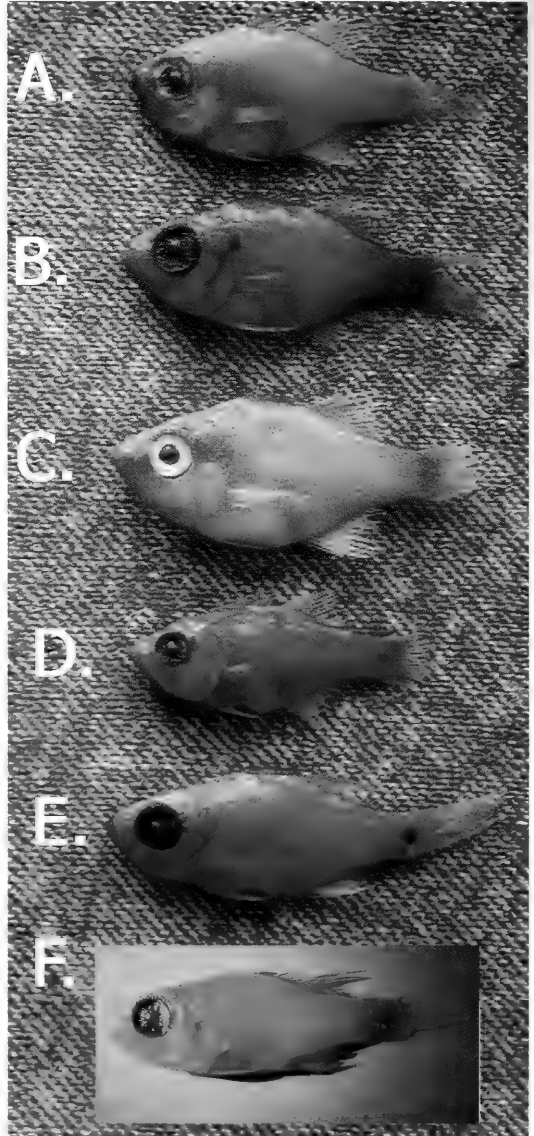


FIGURE 1. Preserved *Zoramia* specimens: 1A: *Z. leptacantha*, CAS 222157; 1B: *Z. gilberti*, CAS 85914; 1C: *Z. flebila*, CAS 222057 (Holotype); 1D: *Z. fragilis* USNM211839; 1E: *Z. viridiventer*, CAS84689; 1F: *Z. perlita*, CAS30740 (Paratype).

28.3 (24.8–31.1; 26.1); prepelvic length 31.8 (31.2–41.0; 35.4); pelvic-fin spine 15.1 (15.1–20.8; 18.3); pelvic-fin length 26.1 (24.6–30.0; 26.2).

Body depth 2.1 (2.1–2.5) in SL; body compressed, the width 2.8 (2.8–3.4) in body depth; dorsal profile of head straight; snout length 4.0 (4.0–5.9) in head length; orbit diameter 2.7 (2.5–2.8) in head length; bony interorbital width 4.5 (4.1–4.7) in head length; caudal-peduncle depth 2.3 (2.1–2.7) in head length; caudal-peduncle length 1.7 (1.4–2.3) in head length.

Mouth very oblique, forming an angle of about 50° to horizontal axis of head, the lower jaw strongly projecting; maxilla extending to below center of eye, the upper-jaw length 2.1 (1.9–2.4) in head length; posterior end of maxilla with a distinct angular notch; dentition as in the genus. Tongue narrowly triangular with rounded tip, the upper surface with small papillae. Gill rakers well developed, the longest on lower limb nearly half orbit diameter in length. Anterior nostril a small, short, membranous tube on side of snout, slightly more than half distance from fleshy edge of orbit to median anterior point of upper lip; posterior nostril a narrow elliptical opening at level of upper edge of pupil, its length about one-fourth pupil diameter.

Suborbital margin smooth, ending below center of eye; preopercular ridge smooth; posterior three-fourths of ventral edge of preopercle and ventral one-quarter of posterior edge finely serrate.

Color of fresh specimen: Top of head and back greenish gray, overlaid with scattered, small melanophores. Two parallel, narrow, yellow lines running along midside from opercle to caudal peduncle. Area below yellow lines lighter than dorsum, silvery under pectoral fins and on belly, a bluish tinge on area above anal fin. Scattered bluish spots above pectoral fin, overlaying yellow lines. Caudal peduncle with heavy concentration of melanophores, forming a dark band at caudal-fin base. A small black spot at center of band. Area below eye, preopercle and opercle silvery, extending back to join silvery belly. Four relatively large teardrop-shaped blue marks under and behind eye, with several more spots extending up along opercular margin. Snout dark green, tip of lower jaw with reddish tinge. Pupil of eye black, iris silvery with a greenish band running horizontally across it at pupil. First two dorsal-fin spines with a reddish tinge, remainder of dorsal fin greenish yellow. Pelvic fins reddish. Caudal fin clear except for greenish dorsal and ventral margins at base. Anal fin clear with a black band along its base and an iridescent blue line next to it on the body. Pectoral fins clear. Often coloration that is blue in life may turn a pink color after the fish is dead but still fresh, thus the color in Figure 2 looks pink. Another photograph of the two DNA specimens shows a blue color.

Color in alcohol: Head and body straw yellow. Top of head and sides of body, except area under and below pectoral fin, covered with tiny, scattered melanophores. Melanophores more concentrated on caudal peduncle, forming a band. A small black spot about half a pupil diameter centered on side of band. Area under eye, preopercle and opercle lacking pigment. Snout and lower jaw with scattered melanophores. Area between isthmus and insertion of pelvic fins with scattered melanophores. Pupil of eye dark, surrounded by silvery iris. First and second dorsal, caudal, and pelvic fins covered with scattered melanophores. Anal fin clear except for a row of melanophores along its base. Pectoral fins clear.



FIGURE 2. Holotype of *Zoramia flebila*, CAS 222057.

TABLE 1. Proportional measurements of type specimens of *Zorania flebila* as percentage of standard length.

	Holotype				Paratypes								
	CAS	CAS	CAS	CAS	BPBM	BPBM	BM(NH)	USNM	USNM	FMNH	AMS	NSMT	SAIAB
	222057	222155	222155	222155	40152	40152	2005.4.25.1	383149	383148	116455	1.43576-001	P70721	75633
Standard length (mm)	40.2	34.6	36.4	39.5	38.4	33.3	39.9	40.4	35.1	43.6	36.4	41.5	36.1
Body depth	47.2	39.7	45.3	46.2	45.9	42.8	45	46.3	40.7	45.6	41.2	44.3	43.5
Body width	16.9	13.7	14.8	13.9	14.9	14.6	14.4	15.1	14.7	14.7	13.3	15.5	12.7
Head length	39.7	39.7	40.3	40.6	38.1	38.6	41.8	38.7	39.6	41.4	38.9	41.4	41.4
Snout length	9.8	7.5	8.1	6.8	8.1	7.8	8	7.3	8	7.1	8.2	7.6	8.4
Orbit diameter	14.8	15.6	15.1	15.6	14.7	15.3	15.3	15.3	15.2	15.6	14.8	15.7	15.5
Interorbital width	8.8	8.4	8.6	9	9.1	9.6	9.5	9.4	9.3	9.6	9.2	9.6	9.7
Upper-jaw length	18.9	17.8	19.6	18	17.9	18.5	18.9	20.2	17.7	19.9	18.7	19.4	18.8
Caudal-peduncle depth	17.1	15.6	16.7	17	18.2	17.3	17.4	16	16.1	16.3	16.5	16.7	15.4
Caudal-peduncle length	23	28.5	26.1	25.1	26	26	26.4	16.6	20.2	24.4	26.2	22.3	26.9
Predorsal length	37.3	36.6	39.5	39.2	37.2	40.2	38.8	41.2	37.7	40.9	39.1	39.6	37.9
Base of first dorsal fin	19	18.2	18.1	14.9	18.2	16.1	18.3	14.6	16.1	16.5	17.9	17.3	16.3
First dorsal-fin spine	10.1	12.1	14.8	13.3	13.3	10.5	broken	12.4	broken	Broken	11.4	13.7	13.7
Second dorsal-fin spine	35.2	broken	broken	22.7	29.6	21.8	25.1	31.2	broken	24.6	27.5	broken	28.2
Third dorsal-fin spine	broken	broken	broken	24.9	19	broken	23.2	21.5	broken	Broken	Broken	broken	22.7
Fourth dorsal-fin spine	21	broken	23.6	17.7	21.5	18.3	broken	19.8	broken	Broken	19	broken	16.6
Fifth dorsal-fin spine	15.5	broken	broken	15.7	14	13.2	14	11.5	12.7	Broken	14.4	12.3	13
Sixth dorsal-fin spine	8.1	broken	9.2	8.6	7.4	7.9	7.3	4.9	6.8	8.1	8.2	8.9	broken
Base of second dorsal fin	20.6	23.4	24.5	23.7	20	21.9	20.9	23.3	21.1	19.2	21.3	23	17.4
Second dorsal-fin spine	14.9	broken	21.1	19.5	16.6	18.3	18.5	broken	16.5	16.2	19.5	17.6	19.1
Longest dorsal ray	26.6	27.2	29.2	broken	broken	28.7	28.3	broken	broken	Broken	broken	broken	broken
Prenatal length	60.1	60.2	63.8	61.2	61.6	55.4	60.8	63.9	57.8	61.5	60.2	59	62.6
Base of anal fin	23.7	22.7	23.4	23.3	21.3	22.2	22.2	20.3	22.2	22.7	24	22.2	20.9
First anal-fin spine	4.8	5.2	5.8	4.8	4.8	5.4	4.4	4.4	4.3	4	4.8	5.8	5
Second anal-fin spine	13	13.9	16.2	16.2	14.6	15.6	15.4	15.3	14.7	13.6	15.4	14.9	15.2
Longest anal ray	broken	27	broken	27.1	25	25.5	27	broken	broken	Broken	27.5	broken	broken
Caudal-fin length	33.2	broken	broken	broken	broken	broken	broken	broken	broken	Broken	broken	broken	broken
Caudal concavity	7.6	broken	broken	broken	broken	broken	broken	broken	broken	Broken	broken	broken	broken
Pectoral-fin length	28.3	30.8	30.2	31.1	27.8	28.5	28.9	29.2	26.5	29.4	28.3	27.7	30.5
Prepelvic length	31.8	31.3	37.3	37	31.2	35.6	36.6	38	32.8	37	33.6	36.9	41
Pelvic spine	15.1	17.5	17.6	19	15.6	15.6	20.2	20.8	17.1	18.8	19.5	17.1	18.3
Pelvic-fin length	26.1	24.8	26.4	30	26.8	25.5	26.4	26.2	24.6	26.4	25.1	27.1	25.9

ETYMOLOGY.— The specific epithet is an adjective from the Latin *flebilis* (tearful), referring to the teardrop-shaped marks on the cheek.

COMPARISONS.— *Zoramia flebila* differs from *Z. leptacantha* by lacking the dark line on the dorsum from the origin of the first dorsal fin onto the caudal peduncle. It also has a caudal spot that *Z. leptacantha* lacks. It differs from *Z. perlita* by lacking the dark lines just above the insertion of some of the anal-fin rays. It differs from *Z. gilberti* by lacking either a prominent or diffuse dark spot on the opercular flap, and by having a significantly ($T=-4.14$, $P=0.000$, $DF=28$) smaller eye (Fig. 3). It differs from *Z. fragilis* and *Z. viridiventer* by having diffuse melanophores on the caudal peduncle in addition to a small caudal spot, by usually having scattered melanophores on the breast, pelvic fins, and posterior part of the second dorsal fin that are lacking in *Z. fragilis* and *Z. viridiventer*. It also has a line of dark pigment along the anal-fin base that is lacking in both species. Whereas *Z. fragilis* and *Z. viridiventer* usually have black tips on the caudal fin, there is no such coloration in *Z. flebila*. The body is deeper (39.7–47.2: 44.1 % SL) in *Z. flebila* than in *Z. viridiventer* and *Z. fragilis* (usually less than 40% SL). *Zoramia flebila* differs from all described species by its distinctive coloration. For a comparison of gill-raker counts, see Table 2.

Two DNA tissue samples, 4020 and 4024, are deposited at the University of Kansas. The voucher specimens for these samples are 4024 = CAS 219847, and 4020 = KU 31970.

***Zoramia viridiventer* Greenfield, Langston and Randall, sp. nov.**

Figs. 1E, 4–6; Tables 2–3.

Apogon fragilis (non Smith) Burgess and Axelrod, 1975:1442, lower fig. (Madang, Papua New Guinea).

Apogon gilberti (non Jordan and Seale) Hayashi, 1980:263, fig. 2 (Ishigaki, Okinawa Prefecture).— Hayashi and Kishimoto, 1983: 36, fig. 39 (Iriomote Island).

Apogon fragilis (non Smith) Russell, 1983:49 (One Tree Island, Capricorn Group, southern Great Barrier Reef).— Wass, 1984:13 (American Samoa).— Fraser and Lachner, 1985:43, fig. 1 (Indonesia to Samoa Islands).— Eichler and Myers, 1997:136, lower fig. (Ryukyu Islands, Marshall Islands and southern Great Barrier Reef).— Okamura and Amaoka, 1997:302, lower right fig., 303 (Amami O Shima Islands).— Myers, 1999:130, pl. 53, fig. C (Palau and southern Marshall Islands).

Zoramia fragilis (non Smith) Randall, 2005:215, middle fig. (western Pacific east to Marshall Islands and Samoa).

TABLE 2. Total gill-raker counts for species of *Zoramia*. Counts are from Fraser and Lachner (1985), except for *Z. flebila*, *Z. fragilis*, and *Z. viridiventer*.

	24	25	26	27	28	29	30	31	32
<i>Z. flebila</i>				8	12	12	1		
<i>Z. fragilis</i>				1	7	28	2		
<i>Z. gilberti</i>					10	27	19	7	2
<i>Z. leptacantha</i>					5	19	18	11	11
<i>Z. perlita</i>			3	18	26	7			
<i>Z. viridiventer</i>	3	24	26	5					

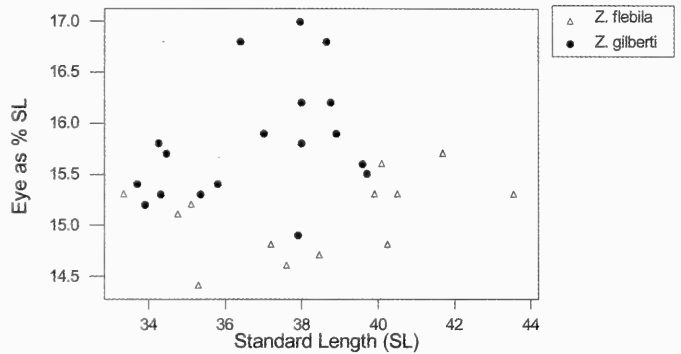


FIGURE 3. Eye diameter as percentage standard length versus standard length. *Zoramia flebila* open triangles, *Z. gilberti* closed circles.

MATERIAL EXAMINED.— Holotype: BPBM 32507, 39.2 mm, Papua New Guinea, Madang Province, lagoon side of Pig Island (Tab Island), coral patch in 17 m, rotenone, J.E. Randall and P.L. Colin, 3 November 1987. Paratypes: CAS 222277, 10: 32.5–40.0 mm, Caroline Islands, Pohnpei, Tokoteihi, inner reefs bordering lagoon west of pass, depth to 4.5 m, rotenone, R.R. Rofer et al., 1 July 1954; CAS 222278, 8: 35.0–38.0 mm, Vanuatu, Espiritu Santo, Palikulo Bay, isolated coral head surrounded by sand, 0.5–4 m, rotenone, R.L. Bolin and R. Persson, 7 October 1958; BPBM 8071, 35: 24.5–36.6 mm, Palau, limestone islet southwest of Urukthapel, fringing reef, 9 m, rotenone, J.E. Randall and E.S. Helfman, 11 June 1968; BPBM 9699, 4: 27.0–31.7 mm, Marshall Islands, Majuro Atoll, lagoon, 2 m, quinaldine, J.E. Randall and A.R. Emery, 30 March 1970; AMS I.17086-009, 10: 33.5–38 mm, Papua New Guinea, Madang Harbor, Paeowai Island, 5°11'S, 145°51'E, 9–11 m, B.B. Collette and party, 25 May 1970; BPBM 15627, 11: 31.5–36.2 mm, Solomon Islands, Alite Reef (off Malaita), lagoon coral head, 3 m, rotenone, J.E. Randall and G.R. Allen, 25 July 1973; BPBM 15684, 25.9 mm, Solomon Islands, Guadalcanal, Honiara Yacht Harbor, patch reef on mud bottom, 14 m, rotenone, J.E. Randall and B. Goldman, 2 August 1973; AMS I.18272-002, 45.0 mm, Australia, Great Barrier Reef, Capricorn Group, One Tree Island, lagoon, R.H. Kuiter, 20 September 1974; BPBM 19220, 4: 33.4–41.3 mm, Indonesia, Molucca Islands, Ambon, Ambon Bay, Poka, adjacent to wreck of ship near dock; silty bottom with iron wreckage, 15 m, rotenone, J.E. Randall and G.R. Allen, 16 January 1975; AMS I.20976-008, 10: 34.5–40.0 mm, Australia, Great Barrier Reef, Lizard Island, off Mrs. Watson's Beach, 10–11 m, D.F. Hoese and H.K. Larson, 24 November 1978; AMS I.43600-001, 3: 37.2–38.5 mm, BMNH 2005.5.10.1-3, 3: 39.2–40.0 mm, BPBM 40155, 6: 33.9–42.3 mm, NSMT-P 70846, 3: 37.9–38.5 mm, SAIAB 75547, 3: 37.1–38.3 mm, all with same data as holotype; BPBM 39077, 2: 26.5–31.3 mm, Papua New Guinea, New Britain, Kimbe Bay, reef off Walindi Plantation, drop-off among branches of sponge, 16 m, quinaldine, J.E. Randall and J.L. Earle, 21 August 2002.

DIAGNOSIS.— A species of *Zoramia* with only the following dark markings: a small black spot midposteriorly on caudal peduncle one-half pupil diameter or more in size; a faint broad dusky band on side of snout directly before eye; some specimens with a faint dusky line at base of dorsal fins; tips of one or both caudal lobes often blackish; second dorsal-fin spine 18.9–21.7% SL; second anal-fin spine 13.0–15.9% SL; gill rakers 24–27 (rarely 27).

DESCRIPTION.— Dorsal-fin elements VI-1.9; anal-fin elements II.9; last dorsal-fin and anal-fin rays branched to base; pectoral-fin rays 14, uppermost and lower two or three unbranched; pelvic-fin rays I.5, all branched; principal caudal-fin rays 17, upper and lower unbranched; lateral-line scales to caudal-fin base 24 (plus one smaller pored scale extending onto base of fin); two near-equal scales above lateral line to base of first two dorsal-fin spines, followed by a series of large scales in a single row below remaining spines and second dorsal fin, these scales overlapping all but narrow upper part of scales below; scales below lateral line to origin of anal fin 5; predorsal scales 6; circumpeduncular scales 12; total gill rakers on first gill arch 6 + 26 (6–7 + 24–27), only one with 7 rakers on upper limb (raker at angle included in lower count).

Body depth 2.6 (2.55–3.3) in SL (specimens less than about 34 mm progressively more slender); body very compressed, the width 2.8 (2.65–2.8) in body depth; head length 2.55 (2.4–2.55) in SL; dorsal profile of head straight; snout length 3.9 (3.95–4.2) in head length; orbit diameter 2.65 (2.6–2.8) in head length; bony interorbital width 4.45 (4.1–4.65) in head length; caudal-peduncle depth 2.4 (2.5–2.75) in head length; caudal-peduncle length 1.6 (1.55–1.7) in head length. (See also Table 3 for additional porportional measurements.)

Mouth very oblique, forming an angle of about 50° to horizontal axis of head, the lower jaw strongly projecting; maxilla extending to below center of eye, the upper-jaw length 2.25 (2.2–2.4) in head length; posterior end of maxilla with a distinct angular notch; dentition as in the genus. Tongue narrowly triangular with rounded tip, the upper surface with small papillae. Gill rakers well developed, the longest on lower limb nearly half orbit diameter in length. Anterior nostril a small, short, membranous tube on side of snout, slightly more than half distance from fleshy edge of orbit to median anterior point of upper lip; posterior nostril a narrow elliptical opening at level of upper

edge of pupil, its length about one-fourth pupil diameter.

Suborbital margin smooth, ending below center of eye; preopercular ridge slightly irregular, but without serrae; posterior three-fourths of ventral edge of preopercle and ventral half of posterior edge finely serrate.

Origin of dorsal fin over third to fourth lateral-line scales, the predorsal length 2.4 (2.4–2.5) in SL; first dorsal-fin spine 3.9 (3.45–4.05) in head length; second or third dorsal-fin spines longest, 1.9 (1.85–2.15) in head length; spine of second dorsal fin 2.3 (2.35–2.5) in head length; first dorsal soft ray longest (second ray nearly as long), 1.5 (1.45–1.5) in head length; first anal-fin spine very short, 7.75 (7.1–8.4) in head length; second anal-fin spine 2.8 (2.5–3.0) in head length; first anal soft ray longest (second ray nearly as long), 1.75 (1.45–1.8) in head length; caudal fin 3.1 (2.9–3.1) in SL; caudal concavity 3.05 (3.0–3.15) in head length; pectoral fins 1.5 (1.5–1.6) in head length, the third or fourth rays longest; pelvic fins reaching or extending slightly beyond anus, the first or second soft rays longest, 1.75 (1.65–1.85) in head length.

Color of holotype in alcohol pale yellowish on head and body, a little dusky dorsally on nape, along base of dorsal fins, and dorsally on caudal peduncle; a roundish black spot posteriorly on caudal peduncle slightly more than half pupil diameter in size; scattered melanophores on posterior half of caudal peduncle but



Figure 4. Holotype of *Zoramia viridiventer*, BPBM 32507.



Figure 5. Underwater photograph of *Zoramia viridiventer* taken at site where holotype was captured.

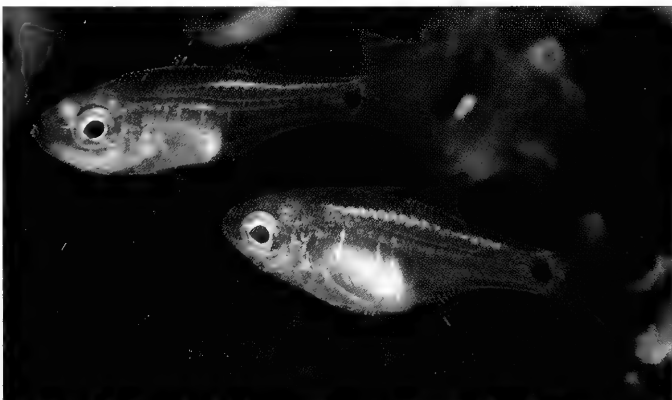


Figure 6. *Zoramia viridiventer* at Karang Elmas Reef, Halmahera.

TABLE 3. Proportional measurements of type specimens of *Zoramia viridiventer* as percentage of the standard length.

	Holotype				Paratypes				
	BPBM 32507	BPBM 39077	BPBM 15627	BPBM 40155	BPBM 40155	BPBM 40155	BPBM 40155	BPBM 40155	BBPM 40155
Standard Length (mm)	39.2	31.3	33.9	35.6	37.5	38.0	39.8	40.4	42.3
Body depth	38.6	35.5	38.2	38.4	37.7	38.7	38.3	39.5	38.6
Body width	13.7	13.4	13.6	13.7	14.6	13.5	14.2	14.1	14.1
Head length	39.5	41.2	41.3	41.7	41.0	41.1	39.1	39.2	40.0
Snout length	10.1	10.2	10.0	10.6	10.3	9.8	9.8	9.9	9.8
Orbit diameter	14.8	16.0	15.5	15.4	15.0	14.6	14.8	14.5	14.2
Interorbital width	8.9	9.2	9.4	9.0	9.1	9.5	9.3	9.6	9.3
Upper-jaw length	17.5	17.5	18.3	17.1	18.6	18.7	17.6	17.4	17.8
Caudal-peduncle depth	16.4	15.7	15.9	16.1	15.9	15.0	15.7	15.8	15.8
Caudal-peduncle length	25.0	24.4	24.6	24.7	24.5	25.5	25.1	25.1	24.4
Predorsal length	41.5	40.0	41.8	40.7	41.0	41.4	39.9	40.1	39.6
Base of first dorsal fin	14.5	15.0	15.4	14.2	15.2	15.4	15.1	14.8	14.3
First dorsal spine	10.2	11.9	10.3	11.2	10.1	10.7	10.5	broken	10.6
Second dorsal spine	21.0	21.6	19.1	18.9	19.0	18.9	19.1	19.0	21.7
Third dorsal spine	20.8	21.3	21.1	19.3	18.7	18.7	18.8	18.7	21.0
Fourth dorsal spine	16.7	17.2	20.3	16.3	16.0	16.1	15.3	14.1	12.2
Fifth dorsal spine	11.6	12.5	12.7	11.4	11.6	12.1	11.3	13.8	10.9
Sixth dorsal spine	7.7	7.4	broken	6.7	7.8	7.6	7.7	7.2	7.1
Base of second dorsal fin	18.6	18.5	18.0	18.1	18.1	18.2	18.1	18.8	17.9
Spine of second dorsal fin	17.3	17.4	17.7	17.0	16.5	17.4	17.4	16.9	16.3
Longest dorsal ray	26.8	27.2	27.7	27.5	27.8	27.8	26.9	26.9	27.4
Base of anal fin	18.4	19.1	18.6	18.6	18.6	18.1	17.7	18.5	18.0
First anal spine	5.1	4.9	5.7	5.4	5.3	5.0	5.5	5.2	4.8
Second anal spine	14.2	15.9	15.1	14.4	14.0	13.9	15.1	13.0	15.8
Longest anal ray	22.9	27.9	broken	28.3	24.0	24.8	24.9	22.4	22.3
Caudal-fin length	32.3	34.5	broken	33.6	33.3	33.0	33.7	32.1	32.5
Caudal concavity	13.0	13.7	--	13.2	13.2	13.4	12.7	12.6	13.0
Pectoral-fin length	26.4	25.6	26.7	26.9	26.5	26.6	25.2	25.2	26.2
Prepelvic length	38.4	40.9	39.3	38.5	40.5	39.9	40.4	38.4	39.0
Pelvic spine	15.8	15.9	16.9	15.4	15.5	16.6	15.6	14.8	14.6
Pelvic-fin length	22.5	23.9	24.0	22.4	24.3	23.7	23.5	22.2	23.7

far less than the density dorsally on body; a faint broad dusky band on side of snout centered slightly below middle of eye; spines and rays of fins translucent yellowish, only the first two dorsal-fin spines and membranes a little dusky; remaining membranes of fins translucent; tips of caudal-fin lobes blackish (faint on lower lobe); the black digestive tract is visible as a faint dark area of the abdomen, becoming near-black as the intestine nears the anus.

Color of holotype when fresh as in Figure 4. The body other than the abdomen is translucent, making the vertebral column visible, and the small blue spots are apparent on the operculum and upper abdomen.

Figure 5 is from an underwater photo of an individual of this species taken at the collecting site of the holotype. The green area posteriorly on the abdomen often covers more of the abdomen, as may be seen in other underwater photographs such as those cited in the synonymy above.

The two fish of Figure 6 were photographed in 50 m at Karang Elmos Reef, Halmahera (0°10'1"N, 128°7'E); note the two vertical blue lines on the side above the pectoral fin.

Underwater photographs of aggregations of this species may show individuals with or without black tips on the caudal lobes. More often than not, at least the upper lobe shows a blackish distal end. As mentioned above, museum specimens often have abraded fins, especially the caudal, so black tips, had they been present, were lost.

ETYMOLOGY.— The specific epithet is a compound adjective from the Latin *viridis* for green and *venter* for abdomen, in reference to the green coloration usually present on the abdomen in life, at least in adults.

COMPARISONS.— *Zoramia viridiventer* differs from *Z. leptacantha* by lacking the dark line on the dorsum from the origin of the first dorsal fin onto the caudal peduncle. It also has a caudal spot that *Z. leptacantha* lacks. It differs from *Z. perlita* by lacking the dark lines just above the insertion of some of the anal-fin rays. It differs from *Z. gilberti* by lacking either a prominent or diffuse dark spot on the opercular flap. It differs from *Z. flebila* by lacking diffuse melanophores on the caudal peduncle in addition to the small caudal spot, and by usually having black tips on the caudal fin. Finally, it differs from *Z. fragilis* by having fewer gill rakers (24–27 verses 27–30), a shorter second dorsal-fin spine (18.9–21.7 verses 21.5–24.8), and a shorter second anal-fin spine (13.0–15.9 verses 15.1–17.9).

REMARKS.— We became suspicious that the material reported by Fraser and Lachner (1985) as *Apogon fragilis* Smith, 1961 might contain two species when we noticed the broad gap in the distribution of the species shown in their Figure 20 between the Seychelles and Sulawesi, and the broad range of the gill-raker counts of *A. fragilis* in their Table 4. Loans of paratypes of *A. fragilis* from Mozambique and specimens from Madagascar identified as *A. fragilis* by Fraser and Lachner provided a nearly complete separation of gill-raker counts from Pacific specimens (Table 2). This difference was reinforced by measurements that demonstrate that the second dorsal and anal-fin spines are generally longer in *Z. viridiventer* than in *A. fragilis*, as shown in our key.

We are not aware of any color photographs taken of *A. fragilis* when fresh or alive from the two localities for the species given by Smith (1961), Pinda, Mozambique and the Seychelles, or from the Madagascar locality reported by Fraser and Lachner. Smith included a painting of the species by Margaret Smith with his description of the species. It shows a pinkish-gray fish, becoming pale bluish gray on the abdomen, with a small black basicaudal spot, strong black stripe on the side of the snout and tip of lower jaw, a blackish line at base of the dorsal fins and dorsally on the caudal peduncle, black tips on the caudal lobes, and an orange line on the anal fin near the base.

Kuiter (1998:86) identified two underwater photographs from the Maldives Islands as *Apogon gilberti*, but neither is *Zoramia gilberti*. The single fish in the figure to the left could be *Zoramia viridiventer*, but without a specimen for study, we cannot be sure. The two fish in the figure to the right are gray with a broad iridescent blue-green stripe on the body at the level of the upper end of the gill opening, a very small black basicaudal spot, black-tipped caudal lobes, and a tiny black tip on the first dorsal fin. They appear to represent an undescribed species.

The distribution of *Zoramia viridiventer* is largely as given for the Pacific part of Fraser and Lachner's Figure 20 for *Apogon fragilis*: Philippines, Indonesia, Palau, Yap and Kapingamarangi in the Caroline Islands, southern Marshall Islands, northern Kiribati, Papua New Guinea, Great Barrier Reef, Solomon Islands, Vanuatu, and Samoa Islands. They reported the third author and associates' collections from Palau (in 1968), Marshall Islands, Solomon Islands, and Papua New Guinea. Randall et al. (2004) reported *Apogon fragilis* from Tonga, but the identification as *viridiventer* is questionable because of slightly higher gill-raker counts in the limited material available.

Hayashi (1980) placed *Apogon fragilis* in the synonymy of *A. gilberti* (Jordan and Seale), type locality, Negros. He reported *A. gilberti* from Ishigaki in the southern Ryukyu Islands; his black and white figure is not *A. gilberti* but appears to be *A. viridiventer*, in which case it would be the first record of the species from Japanese waters. We conclude the same for Hayashi and Kishimoto (1983) who reported *A. gilberti* from Iriomote Island in the Ryukyus.

Russell (1983) was the first to record this species from Australia (as *Apogon fragilis*). He listed two specimens, AMS I.18267-005 and I.18271-002, from One Tree Island, Capricorn Group,

southern Great Barrier Reef. The former was found at the Australian Museum by Mark A. McGrouther and Sally Reader, who reported it as "dried out beyond retrieval." The latter is a species of *Canthigaster*. The number Russell should have given was AMS I.18272-002, 45 mm SL. It is included above as one of the paratypes of *Zoramia viridiventer*, as is one lot from Lizard Island in the northern Great Barrier Reef.

This species is usually seen in aggregations in lagoons or bays, sheltering among branching corals, sponges, etc. Our collections have come from the depth range of 2–17 m, but as noted above, the species may be seen at least as deep as 50 m.

ACKNOWLEDGMENTS

We thank K.R. Longenecker and B.K. Mataitini for assistance in collecting specimens, and Captain B. Vasconcellos and the crew of the *Moku Moku Hine* for assistance in the field. We are grateful to J. Seeto, G.R. South, R.R. Thaman, and R.W. Tuxton of the University of the South Pacific, Fiji for facilitating our collecting in Fiji. We also thank the Fijian Government and local village chiefs for permission to collect fishes. We thank M. McGrouther and S. Reader of AMS and J.T. Williams of USNM for lending specimens. Special thanks to the staff at CAS for providing assistance: D. Catania, W.N. Eschmeyer, J. Fong, M. Hoang, and T. Iwamoto. The authors also appreciate the helpful comments of the anonymous reviewers. This research was supported by National Science Foundation grants INT97-29666 and DEB0-1027545, and Sea Grant Project R/FM-6PD.

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Scanning Electron Microscope Studies of Some Early Miocene Diatoms from the Equatorial Pacific Ocean with Descriptions of Two New Species, *Actinocyclus jouseae* Barron and *Actinocyclus nigriniaie* Barron

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Scanning electron microscope (SEM) and light microscope (LM) studies are used to propose and describe two new species, *Actinocyclus jouseae* Barron, sp. nov. and *Actinocyclus nigriniaie* Barron, sp. nov. from lower Miocene sediments from equatorial Pacific ODP Site 1219. Parallel SEM and LM studies reveal that *Thalassiosira bukryi* Barron should be transferred to *Azpeitia* and suggest that *Actinocyclus barronii* Radionova is likely to be a variety of *A. radionovae* Barron

During the study of the biostratigraphy of diatoms from lower Miocene (24–17 Ma) sediments of equatorial Pacific ODP Site 1219 (7°48.019'N, 142°00.940'W; 5063 m water depth) (Barron, in press), two species of *Actinocyclus* were observed that were not described by either Barron (1983) or Radionova (1991). Description of these new taxa and clarification of the taxonomic relationships of three other early Miocene diatoms from ODP 1219 warrants detailed study under LM and SEM. The purpose of this paper is to detail the valve ultrastructure of these fossil taxa and resolve their taxonomic position.

METHODS AND MATERIALS

For the biostratigraphic study of Barron (in press), Cores 4H through 6H (ca. 24.5 to 17.0 Ma) of ODP Hole 199-1219A were sampled at 50 cm intervals, with occasional samples taken at 30 cm intervals. Approximately 1 g of material was placed in a 250 ml beaker, disaggregated with a wooden stirring rod, and covered with distilled water. Dilute (ca. 3%) hydrochloric acid was then added to remove the calcium carbonate. After the reaction ceased, the sample was washed with distilled water and centrifuged at 1200 rpm for 4 minutes duration in order to bring the solution to a neutral pH. After completion of the washing process, strewn slides were prepared by transferring the suspended material with a disposable pipette to a 22 × 40 mm coverslip, which was then dried on a hot plate and mounted with Naphrax on a 25 × 75 mm glass slide.

These slides were examined in their entirety under a light microscope (Leitz Ortholux) at magnification ×500, with identifications checked at ×1250. The LM photography was completed using a Spot Insight v. 4.0 digital camera on a Leica DML microscope. SEM studies were completed on selected samples with a Leo 1450VP microscope.

DESCRIPTIONS OF NEW SPECIES

***Actinocyclus jouseae* Barron, sp. nov.**

Plate 1, figs. 1, 4, 5; Plate 2, figs. 1, 2.

NOMENCLATURAL SYNONYM: *Actinocyclus challengerii* Jousé in Jousé, (ed.), 1977, pl. 57, figs. 10, 24–25, 36, nom invalid (no description). This name is a later homonym of *A. challengerii* O'Meara, 1876.

DESCRIPTION.— Diameter 33 to 95 μm . Linear rays of areolae increasing in size from 8–9 in 10 μm near the center to about 5 in 10 μm near the margin. Typically each primary (or sub-primary) ray is joined by one secondary ray. High (4–5 μm high) mantle near margin covered by dense areolae, about 8–10 in 10 μm . Prominent pseudonodule (circular, about 0.7 μm in diameter) located at crest of margin. Valve surface undulated, with a raised marginal region, which occupies about one third of the valves diameter. This is followed inward by an abrupt depression and a gentle rise to the valve's center. Primary radial areolar rays extend from the valve's center to the raised marginal region. These are separated by three shorter, secondary areolar rays.

COMMENTS.— *Actinocyclus jouseae* resembles the early middle Miocene diatom, *A. ingens* var. *nodus* Baldauf in Baldauf and Barron (1980) in that the valve is undulated with a raised center and it possesses a dense radial, linear pattern of areolae. Whereas the areolae of *A. jouseae* increase in size from 8 to 9 in 10 μm near the center to about 5 in 10 μm near the margin, the areolae of *A. ingens* var. *nodus* decrease in size toward the margin (5 areolae in 10 μm near the center to 9 areolae in 10 μm near the margin). This character gives the areolar pattern of *A. jouseae* a finer, denser appearance than that of *A. ingens* var. *nodus*.

DERIVATION OF NAME.— In honor of Anastasia P. Jousé, diatomist and pioneer diatom stratigrapher.

MATERIAL EXAMINED.— HOLOTYPE: CAS accession number 625066, CAS slide number 221091, ODP 1219A-4H-4, 58–59 cm (Plate 1, figure 1), Deposited at the California Academy of Sciences, San Francisco; PARATYPES: CAS slide number 221090, ODP 1219A-4H-4, 8–9 cm (Plate 1, figure 4); CAS slide number 221092, ODP 1219A-4H-5, 8–9 cm (Plate 1, figure 5).

STRATIGRAPHIC RANGE.— early Miocene (20.0–19.1 Ma) (Barron, in press).

***Actinocyclus nigrinia* Barron, sp. nov.**

Plate 1, figs. 2, 3, 6, 7; Plate 2, figs. 3, 4.

NOMENCLATURAL SYNONYMS: *Cestodiscus* sp. 6 of Schrader, 1976, pl. 12, fig. 4.; *Cestodiscus kugleri* sensu Fourtanier, 1991, pl. 1, fig. 5.

DESCRIPTION.— Diameter 15 to 70 μm . Number of rays: three to four rudimentary rays in small specimens to 15 in larger specimens. Areolae decrease slightly in size from 8 in 10 μm near valve center to 11–12 in 10 μm near margin. Steep mantle, densely areolated 11–12 areolae in 10 μm . Prominent rounded pseudonodule located near crest of submarginal ring. Valves dimorphic, convex and concave, larger specimens tend to be flatter; smaller specimens tend to be domed. Distinctive “star-like” hyaline rays, which consist of a primary areolar row beginning near the center of the valve, and three to four additional rays of areolae on either side of the primary row, beginning at regular distances toward the margin. Note: Similar to *Cestodiscus praerapax* Radionova, 1991, pl. IV, figs. 1, 12; however, it lacks stripes on margin (N. Radionova, 2005, written commun.)

COMMENTS.— *Actinocyclus nigrinia* resembles *Cestodiscus kugleri* Lohman 1974; however, its radial hyaline rays are less step-like in appearance and its valves possess a prominent pseudonodule on their raised, submarginal ring. *Actinocyclus nigrinia* is also similar to *Cestodiscus praer-*

apax Radionova, 1991, pl. IV, figs. 1, 12; however, it lacks stripes on margin (N. Radionova, 2005, written commun.)

DERIVATION OF NAME.— In honor of Cathy Nigrini, radiolarian biostratigrapher.

MATERIAL EXAMINED.— **HOLOTYPE:** CAS accession number 625068, CAS slide number 221093, ODP 1219A-5H-6, 110–111 cm (Plate 1, figure 6). Deposited at the California Academy of Sciences, San Francisco. **ISOTYPES:** CAS slide number 221093, ODP 1219A-5H-6, 110–111 cm (Plate 1, figure 2); CAS slide number 221093, ODP 1219A-5H-6, 110–111 cm (Plate 1, figure 3); CAS slide number 221093, ODP 1219A-5H-6, 110–111 cm (Plate 1, figure 7).

STRATIGRAPHIC RANGE.— early Miocene (22.7–22.3 Ma) (Barron, in press).

NEW COMBINATION

Azpeitia bukryi (Barron) Barron, n. comb.

Plate 3, figs. 1–5; Plate 4, figs. 1–5.

BASIONYM: *Thalassiosira bukryi* Barron, 1983:511, plate IV, fig. 1.

ORIGINAL DESCRIPTION.— “Flat, round valve 20 to 60 μm in diameter. Hexagonal areolae (about 7 in 10 μm) arranged in a sublinear to eccentric pattern in the central $\frac{1}{3}$ s of the valve with 2 to 4 marginal eccentric rows of progressively smaller areolae (9 to 12 in 10 μm). Areolae pattern resembles that of *Thalassiosira oestrupii* (Ostenfeld) Proshkina-Lavrenko. A small hyaline central area about 1–2 μm in diameter is often present, especially in larger forms, commonly containing a rounded central nodule. Numerous small pores dispersed over the valve face separated by 3 to 4 of the larger areolae. Marginal apiculi separated by 7 small areolae. Thin striated margin (1 μm in width) with 10 radial striae in 10 μm .”

HOLOTYPE.— USNM 348710, Plate IV, fig. 1, sample DSDP 77B-28-6, 28–30 cm

EMENDED DESCRIPTION.— *Azpeitia bukryi* (Barron) Barron possesses a ring of weakly stalked, rimoportulae opening on the valve/mantle interface (Plate 4, figures 1, 3) that are all similar in appearance (Plate 4, figure 3). Although no distinct annulus is present (Plate 3, figures 3–5), larger valves commonly possess a slightly off-center central process (rimoportulae) that is surrounded by a hyaline area (compare Plate 3, figures 1–3). When viewed under the SEM (Plate 3, figures 3–5), the eroded remains of this central rimoportulae shows little or no external projection (Plate 3, figure 5) in a manner similar to that of *Azpeitia tabularis* (see Figure XIV, 1B of Fryxell et al., 1986). Numerous interocular pores appear on the valve’s surface (Plate 3, figures 1–5; Plate 4, figure 4) that are assumed to be rimoportulae. The internal openings of these rimoportulae, however, are eroded in the specimens examined so far under the SEM and are not diagnostic (Plate 4, figure 5). Because satellite pores of strutted processes are normally preserved in fossil material even when the tubes of strutted processes have been eroded (Hasle, 1985), it is assumed that these processes are labiate processes.

Areola are loculate with external cribra lying slightly below the valve surface (Plate 4, figures 2, 4), arguing against placement in *Thalassiosira*. Elongated areolae separate the tube-like chambers of the marginal rimoportulae (Plate 3, figures 3–4; Plate 4, figure 3). This distinctive marginal structure gives the appearance of being striae in LM (Plate 3, figures 1–2). Girdle bands have not yet been observed in the fossil material of *A. bukryi*.

COMMENTS.— *Azpeitia* is “characterized by valves with a nearly central labiate process often on the edge of an annulus, a ring of labiate processes on the valve mantle, specialized areolar patterns of the mantle differing from those on the face of the valve, and two or more (usually three) hyaline girdle bands including a wide valvocopula” (Fryxell et al. 1986).

The regular ring of marginal rimoportulae, the shallow mantle with a valve structure differing from that of the valve face, the loculate areolae with external cribra all support transfer of *T. bukryi* to *Azpeitia*. Similarly, like many species of *Azpeitia*, *T. bukryi* seems to have preferred warmer waters during its early Oligocene to early Miocene range (Barron et al. 2004).

The marginal rimoportulae, structure of the shallow mantle and presence of numerous, scattered rimoportulae on the valve surface closely resemble those of *Azpeitia biannulata* Sims in Mahood et al. (1993), which was described from the lower Oligocene of Prydz Bay, Antarctica.

STRATIGRAPHIC RANGE.— early Oligocene to early Miocene (33.1–17.5 Ma) (Barron et al. 2004; Barron, in press).

COMPARISON OF *ACTINOCYCLUS BARRONII* RADIONOVA AND *A. RADIONOVAE* BARRON

Radionova (1985, 1987, 1991) studied early Miocene diatoms from DSDP Sites 63, 65, 66, 166, 289, 574, 575, providing SEM illustrations of many taxa and describing five new species, *Actinocyclus barronii*, *A. mutabilis*, *A. praellipticus*, *Cestodiscus umbonatus*, and *C. praerapax*. Although her species *A. barronii* closely resembles *A. radionovae* Barron 1983, Radionova (1991) stated that it differed from *A. radionovae* by its having (1) a considerably smaller undulation of the valve, (2) the absence of shortened lines of areolae, (3) the presence of hyaline ribs surrounding the central hyaline field. During the study of the early Miocene diatoms of ODP 1219A, it became clear that further taxonomic study was necessary to distinguish the two species of *Actinocyclus*.

Actinocyclus barronii Radionova, 1985

Actinocyclus barronii Radionova, 1985:72, pl. 1, fig. 1; Radionova, 1991:65, pl. V, figs. 2, 4.

DESCRIPTION (taken from Radionova [1991] because an English translation for that paper was available).— “Valve round, sometimes oval, 60–100 μm , slightly concave. Central part of valve ($\frac{1}{2}$ of its diameter) occupied by a flat hyaline field. This field has a polyangle as star-shaped and connects with the rest of the valve by hyaline ridges, which continue in the line of areolae and reach to the margin of the valve. Pseudonodule large, without operculum. On the mantle of the valve occur 8–10 rimoportulae, which on the external surface are ended by a side aperture, which is a little smaller than the pseudonodule. Mantle is short (low), margin with rough striae.”

COMMENTS.— Extensive examination of Site 1219 material reveals that specimens assignable to *A. barronii* possess shortened lines of areolae (Plate 5, fig. 2) and appear to only differ from the considerable variation in the morphology of *A. radionovae* (Plate 5, figs. 1, 2–6) by the much-reduced undulation of their valves. It is not clear what Radionova (1991) means by hyaline ribs surrounding the central hyaline field (compare Plate 5, figs. 1–2, 5). Given also that the range of specimens assignable to *A. barronii* falls completely within the range of *A. radionovae*, it would appear that *A. barronii* represents a variety of *A. radionovae*. This hypothesis would have to be confirmed by an examination of Radionova’s (1985) type material of *A. barronii*.

STRATIGRAPHIC RANGE.— early Miocene (19.9–19.1 Ma) (Barron, in press).

Actinocyclus radionovae Barron, 1983

Actinocyclus radionovae Barron, 1983:504, pl. III, figs. 1–3; pl. IV, figs. 4–6; Barron, 1985, pl. 1, fig. 2; Radionova, 1991:65, pl. V, fig. 1.

DESCRIPTION (Barron, 1983).— “circular valve with undulating surface 40 to 100 μm in diameter. Hyaline central area 10 to 25 μm in diameter with primary and secondary rows begin-

ning at different distances from the valve's center, giving a 'star burst' appearance. Submarginal area with eroded labiate processes similar to those of *Cestodiscus* arranged radially every 7 to 10 μm . Margin 2 μm wide with 9 to 13 striae every 10 μm . Prominent rounded lunate pseudonodule located near the margin."

COMMENTS.— In the present study considerable variation has been observed in forms assigned to *A. radionovae*. Both concave valves with hyaline centers (the type concept) and convex valves with centers filled by continuation of the areolar rays appear to occur, especially amongst smaller (<50 μm diameter) forms (Plate 5, figures 1, 3–6).

STRATIGRAPHIC RANGE.— early Miocene (22.0–19.1 Ma) (Barron, in press).

ACKNOWLEDGMENTS

Robert Oscarson, USGS, provided invaluable assistance with the SEM. This manuscript benefited from the comments of Nora Radionova and the critical reviews of Mary McGann and Scott Starratt. I am also grateful to Ms. Pat Sims of the British Museum for her very helpful comments on the transfer of *Thalassiosira bukryi* to *Azpeitia*. An anonymous reviewer also offered helpful comments.

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Plates

Plate 1

1 *Actinocyclus jouseae* Barron n. sp. Holotype, CAS slide number 221091, pseudonodule at 5 o'clock, ODP 1219A-4H-4. 58–59 cm.

2, 3 *Actinocyclus nigrinia* Barron n. sp., Isotypes, CAS slide number 221093, pseudonodules at 10 o'clock and 1 o'clock, ODP 1219A-5H-6. 110–111 cm.

4a, 4b *Actinocyclus jouseae* Barron n. sp., Paratype, CAS slide number 221090, low and high focus, pseudonodule just below 3 o'clock, ODP 1219A-4H-4. 8–9 cm.

5 *Actinocyclus jouseae* Barron n. sp., Paratype, CAS slide number 221092, larger form with more complex rays, pseudonodule at 9 o'clock, ODP 1219A-4H-5. 8–9 cm.

6 *Actinocyclus nigrinia* Barron n. sp., Holotype, CAS slide number 221093, pseudonodule at 1 o'clock, ODP 1219A-5H-6. 110–111 cm.

7 *Actinocyclus nigrinia* Barron n. sp., Isotype, CAS slide number 221093, pseudonodule at 2 o'clock, ODP 1219A-5H-6. 110–111 cm.

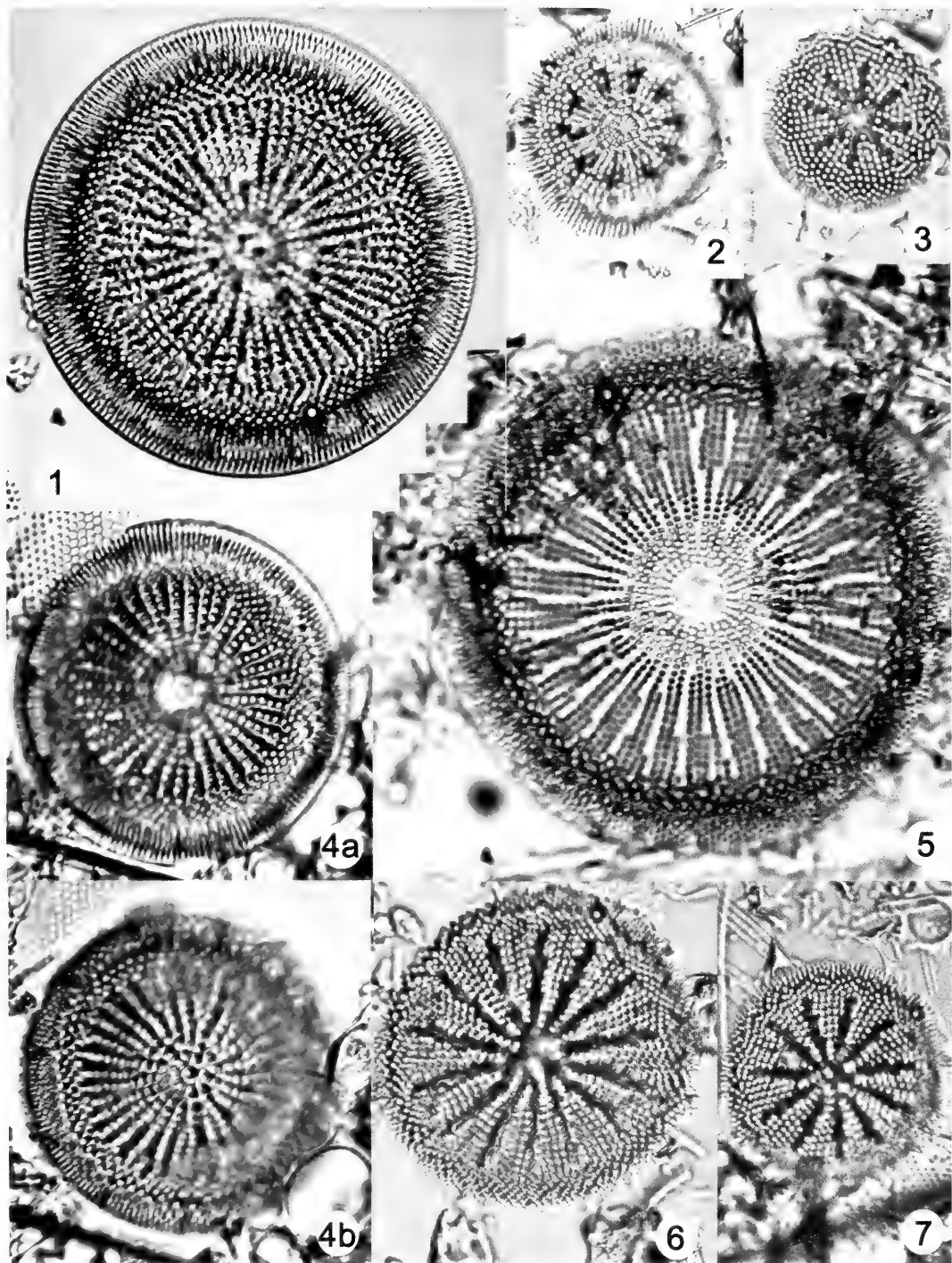


Plate 2

Scale bars for Figs. 1, 2a, 3a, 4a = 20 μm ; for Figs. 2b, 3b, 4b = 5 μm .

1 *Actinocyclus jouseae* Barron n. sp., external view of valve, Isotype CAS accession number 625066, ODP 1219A-4H-4, 58–59 cm.

2a *Actinocyclus jouseae* Barron n. sp., internal view of valve, Isotype CAS accession number 625066, ODP 1219A-4H-4, 58–59 cm.

2b Close-up of Fig. 2a showing pseudonodule and eroded labiate processes on steep mantle.

3a *Actinocyclus nigrinia* Barron n. sp., external view of valve with concave center, Isotype, CAS accession number 625068, ODP 1219A-5H-6, 110–111 cm.

3b Close-up of margin of Fig. 3a showing pseudonodule.

4a *Actinocyclus nigrinia* Barron n. sp., internal view of valve, Isotype, CAS accession number 625068, ODP 1219A-5H-6, 110–111 cm.

4b Close-up of internal opening of pseudonodule of Fig. 4a.

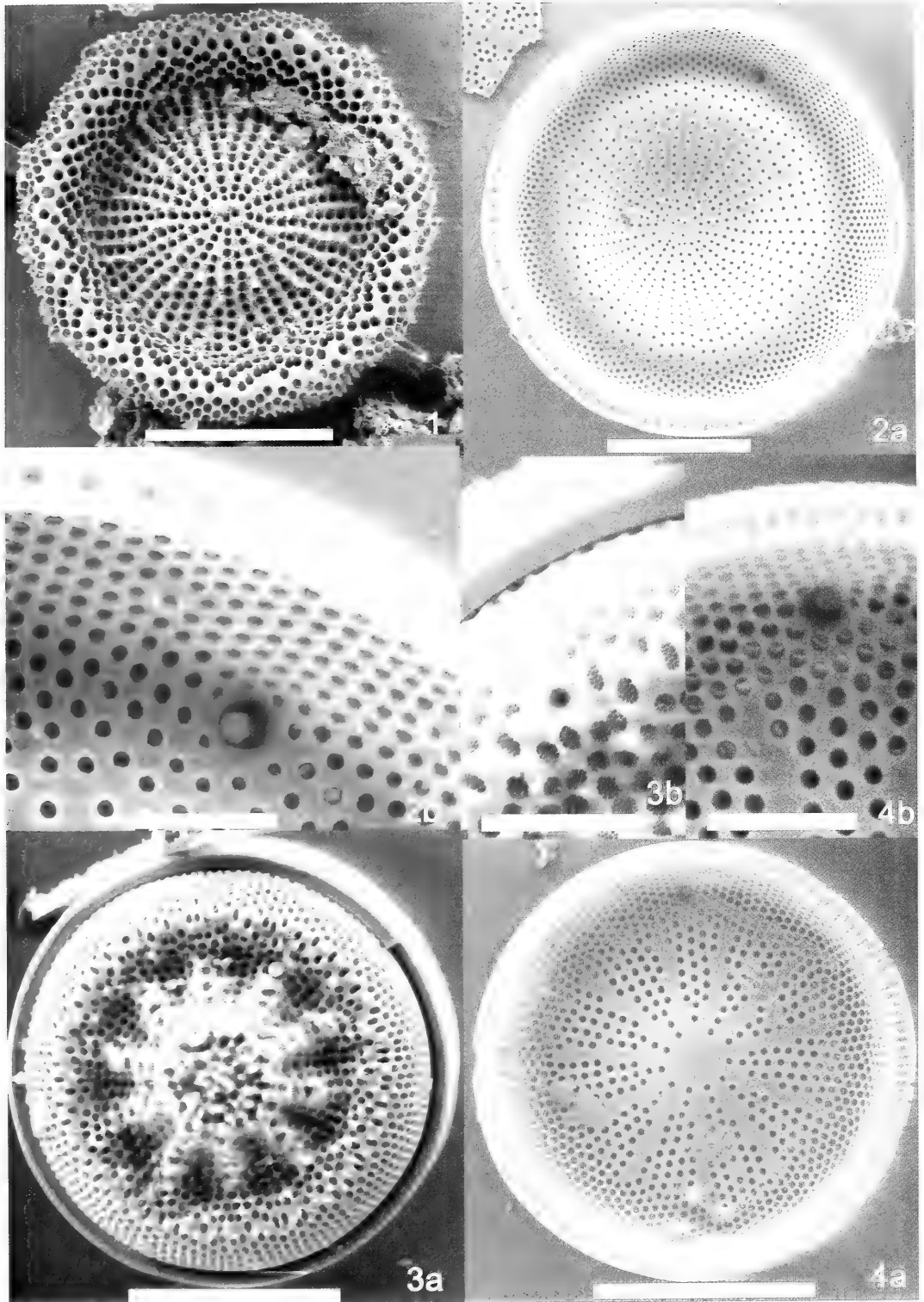


Plate 3

Azpeitia bukryi (Barron) Barron n. comb., LM and SEM photos.

1, 2 LM views of valve, ODP 1219A-6H-1, 108–109 cm, scale bar = 20 μ m.

3 SEM, External view of valve ODP 1219A-5H-1, 108–109 cm.

4 SEM, External view of valve, showing possible eroded central process, ODP 1219A-4H-4, 58–59 cm.

5 Detail of fig. 4 (enlarged 3X).

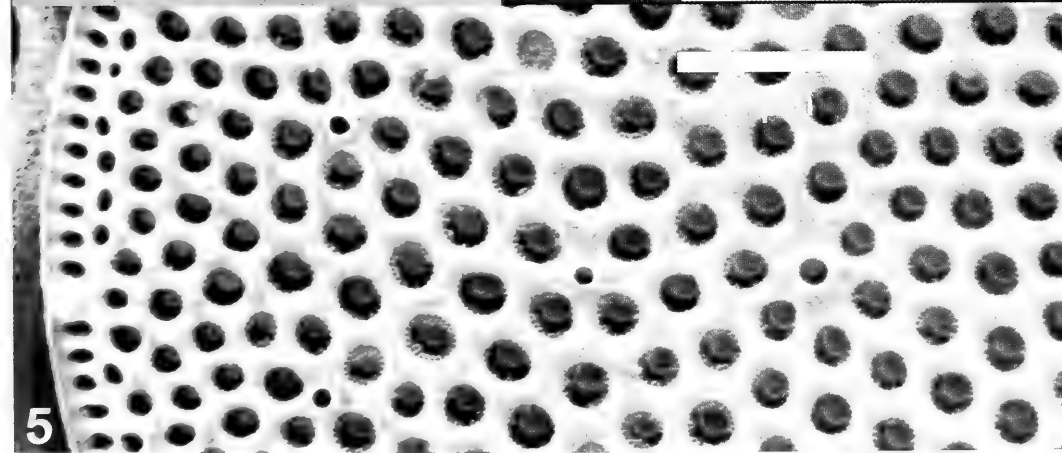
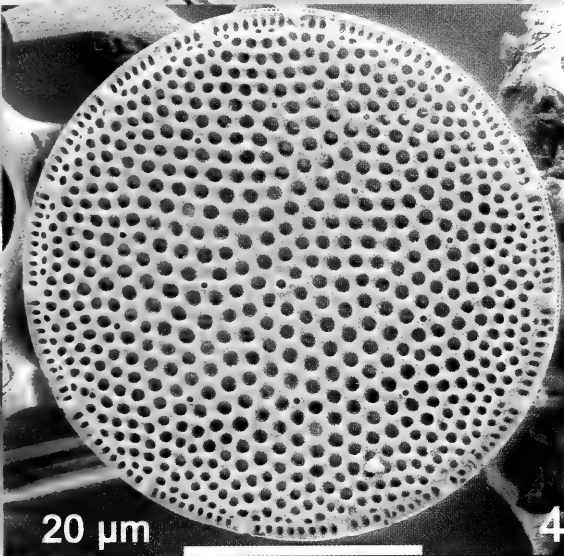
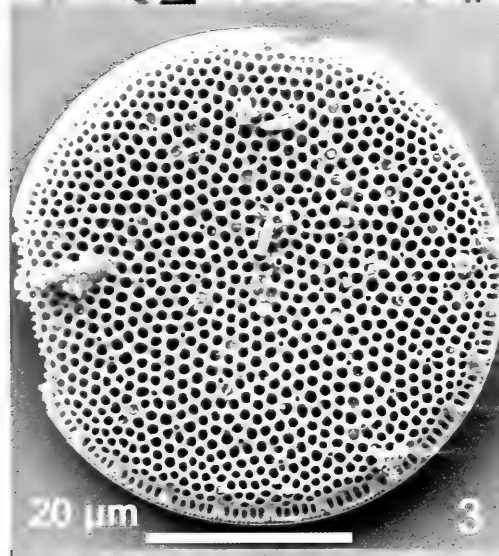
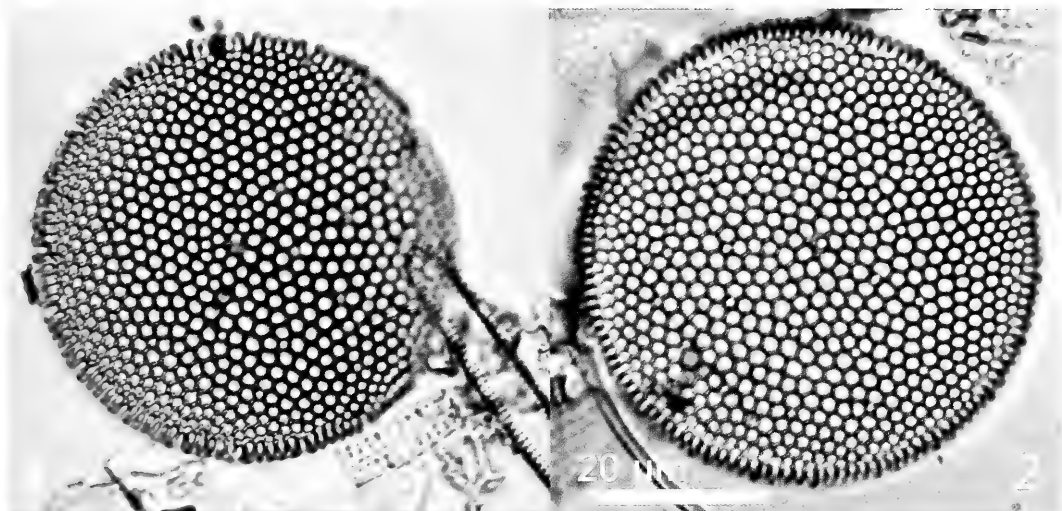


Plate 4

Azpeitia bukryi (Barron) Barron n. comb., SEM photos.

- 1 Internal view of eroded marginal labiate processes. ODP 1219A-5H-1, 108–109 cm.
- 2 Detail of margin. ODP 1219A-5H-1, 108–109 cm.
- 3 Internal view of eroded valve. ODP 1219A-4H-4, 58–59 cm.
- 4 Detail of cribra and small openings. ODP 1219A-5H-1, 108–109 cm.
- 5 Detail of Fig. 3 (enlarged 2X).

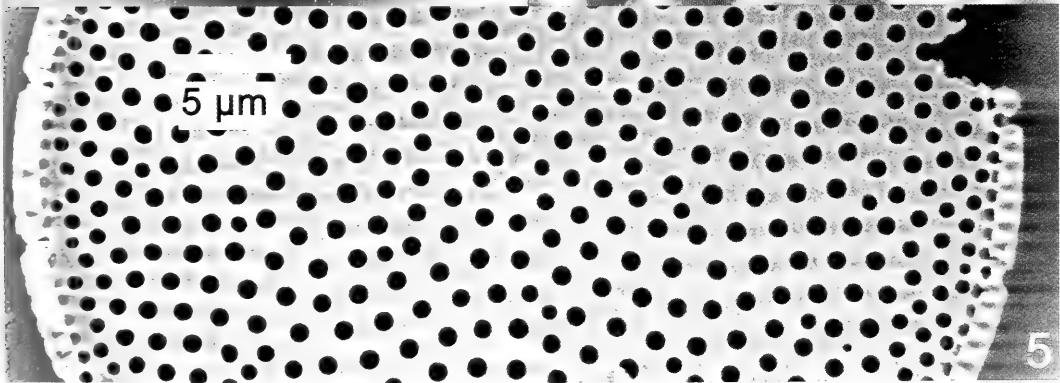
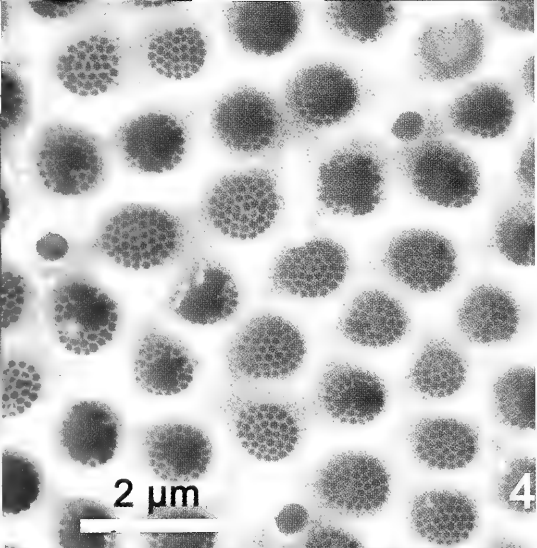
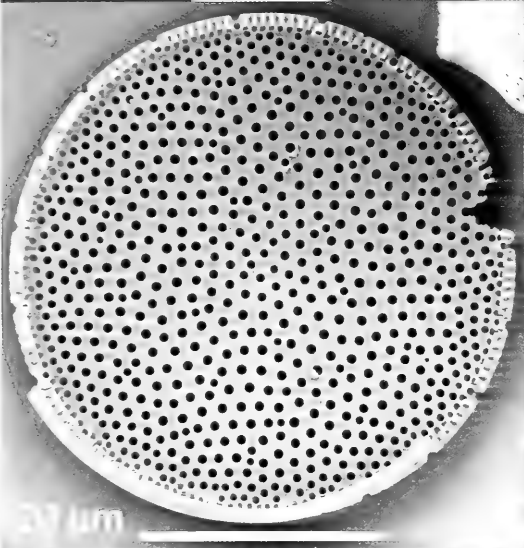
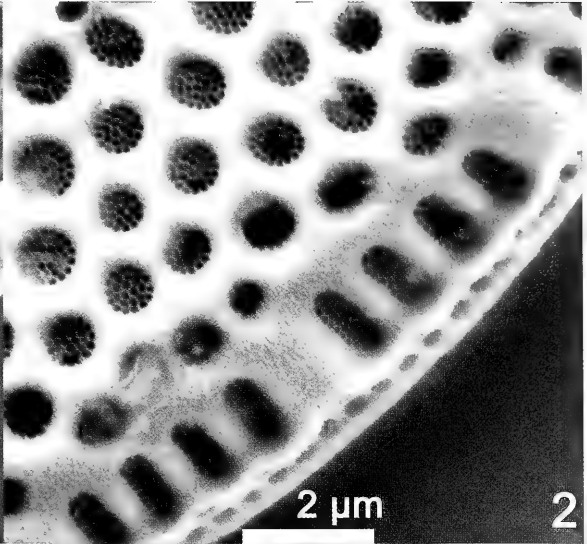
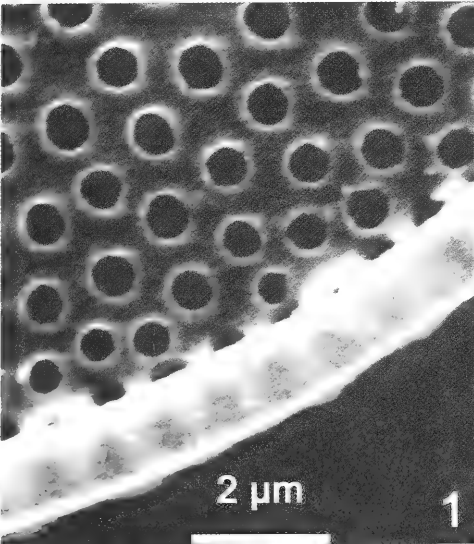


Plate 5

Scale bars for all figs. = 20 μ m

1 *Actinocyclus radionovae* Barron, external SEM, ODP 1219A-4H-4, 58–59 cm.

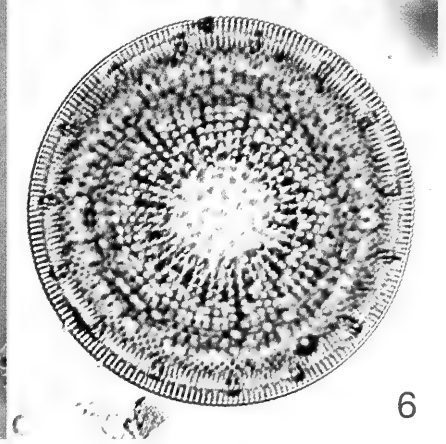
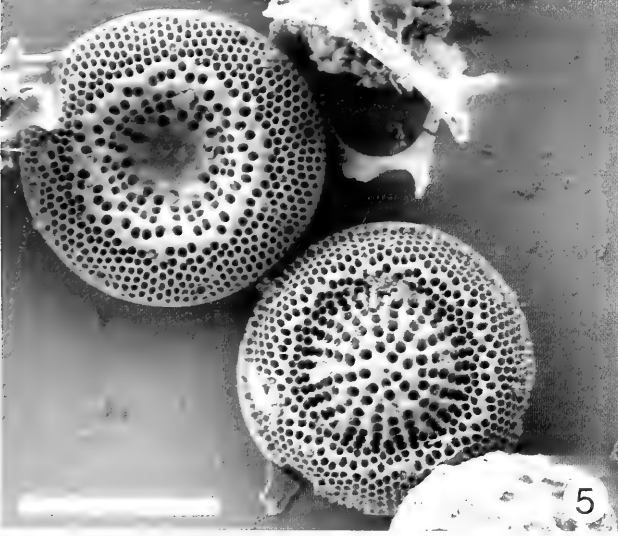
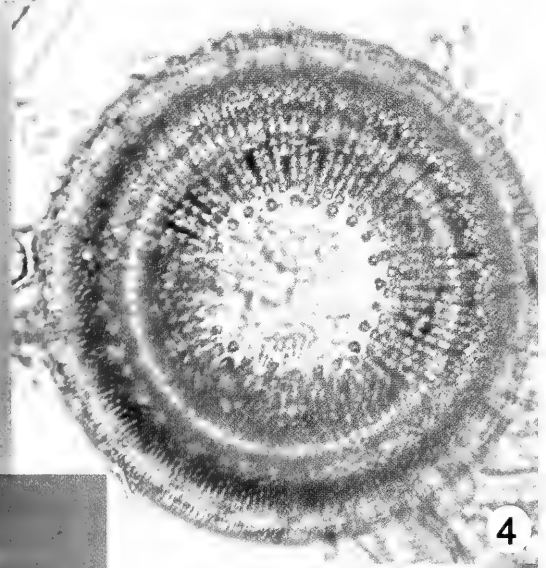
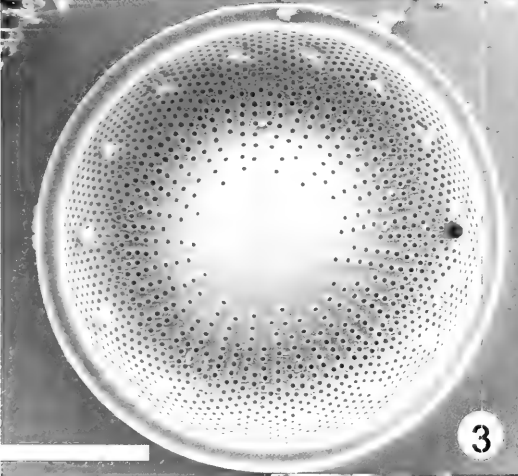
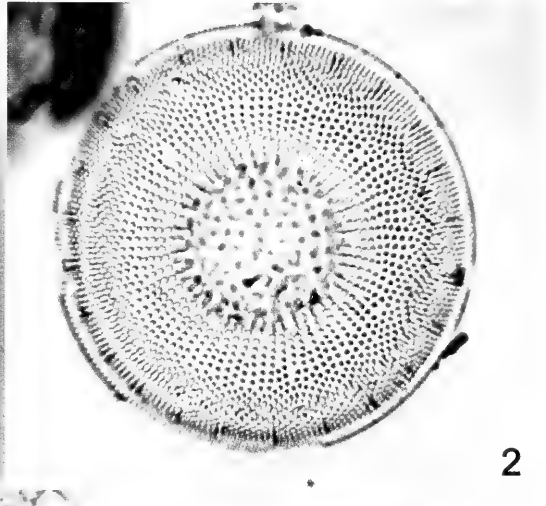
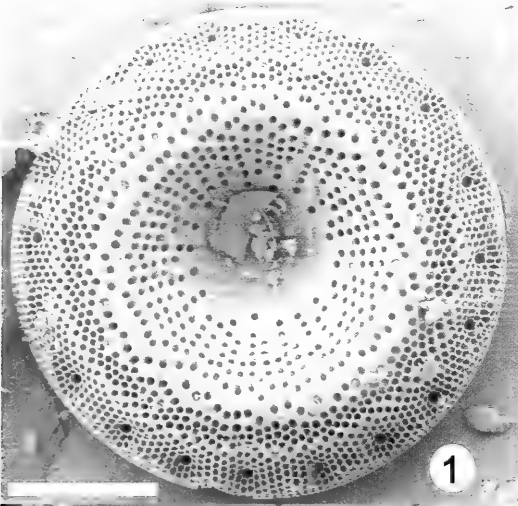
2 *Actinocyclus barronii* Radionova, external LM, pseudonodule at 1 o'clock, ODP 1219A-4H-4, 58–59 cm.

3 *Actinocyclus radionovae* Barron, internal SEM, showing mushroom-shaped labiate processes, and internal opening of pseudonodule at 3 o'clock, ODP 1219A-4H-4, 58–59 cm.

4 *Actinocyclus radionovae* Barron, Holotype of Barron, 1983, USNM 348702, DSDP 495-33-5, 72–76 cm.

5 Concave and convex specimens of *A. radionovae*. s.l. ODP 1219A-4H-4, 58–59 cm.

6 *Actinocyclus radionovae* Barron, pseudonodule at 5 o'clock, ODP 1219A-4H-4, 58–59 cm.



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**A New Species of *Discothyrea* Roger from Mauritius and
a New Species of *Proceratium* Roger from Madagascar
(Hymenoptera: Formicidae)**

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The worker of *Discothyrea berlita* sp. nov. from Mauritius is described. This is the first record of the genus from Mauritius. *D. berlita* is known from a single locality, Le Pouce, a small sanctuary of native ants on an island overrun with invasive ant species. *Proceratium avium* is recollected at Le Pouce and is the senior synonym of *Proceratium avioide* de Andrade (syn. nov.). The practice of manually removing alien plants from native forest plots in Mauritius is not advised for the Le Pouce forest patch because this practice facilitates the establishment of invasive ants, which eliminate native ants. *Proceratium google* sp. nov. is described from Madagascar.

KEYWORDS: Conservation, *Discothyrea*, Formicinae, Hymenoptera,
Invasive, Madagascar, Mauritius, *Proceratium*.

In May 2005, I joined a team of Malagasy ant specialists on an expedition to the island of Mauritius, where we conducted an ant inventory and a search for indigenous species. The status of the remaining native species of Mauritius was called into question by P.S. Ward (1990). In inspired literary prose, he described, as W.L. Brown (1974) did earlier, the alarming difficulty of finding native species. Habitat destruction and introduced ants and plants dominate the landscape, pushing native ants up to and possibly over the brink of extinction.

Mauritius has had a long history of exploitation, habitat modification and extinction. With the extinction of the dodo in 1681, 80 years after humans first arrived on Mauritius, colonizers continued to modify habitat at an alarming rate (Lorence and Sussman 1986). The dense Mauritian forests were converted into tea and sugar plantations in the 19th century. During this time, habitat modification on Mauritius reached to almost every corner of the island (Safford 1997). Mauritius is an instructive example of what could happen to other insular environments, such as Madagascar, if habitat destruction is left unchecked. On Mauritius, as on Madagascar, invasive plant and animal species pose major problems. Once established, many invasive ants in Mauritius may be virtually impossible to eradicate, thus preventing the return of native ants (Holway et al. 2002).

The known native ant fauna of Mauritius includes 18 valid species, with 9 endemic to the island (Table 1). It is interesting that the endemic ants are all confined to upland forest. One could conclude that Mauritius has few endemics all of which are on mountaintops. On the other hand, these endemics could be the only remaining examples of a much richer endemic fauna that disappeared with the destruction of the lowland forest. The discovery of a new genus record on Le Pouce, suggests that there are more species to discover on the island and that Le Pouce is a surprising sanctuary of taxonomically peculiar endemic ants.

The site encompasses a rugged and spectacular mountain chain above the industrial city of Port Louis in north-west Mauritius. The main ridge runs approximately east to west, and three long spurs extend northward. Major peaks include Pieter Both (823 m), Le Pouce (812 m) and Montagne Ory (c.700 m). Le Pouce captures moisture from the prevailing wind and clouds, resulting in the presence of native cloud-forest there. This is the only remaining area of native vegetation, although native plants are scattered throughout the range. Exotic vegetation dominates, most notably a scrub of strawberry guava (*Psidium cattleianum*) and privet (*Ligustrum robustum*) — but grassland and *Eucalyptus* plantations also occur. The best native forest found during our trip, and also the place of greatest number of endemic ants, was a small patch of forest, less than one hectare in area, just at the southeast face of the peak. Based on our survey results across the island, this forest patch on Le Pouce is the only remaining forest refuge for these mountain endemics of Mauritius and should receive high conservation priority.

TABLE 1 List of valid names for native ants recorded from the island of Mauritius. Native ants restricted to Rodrigues (*Monomorium elongatum* Smith, 1876, *Tapinoma fragile* Smith, 1876, *Tapinoma pallipes* Smith, 1876) are excluded. Species in bold are endemic to the island.

<i>Camponotus aurosus</i> Roger, 1863
<i>Camponotus grandidieri</i> Forel, 1886
<i>Crematogaster sewellii</i> Forel, 1891
<i>Dicothyrea berlita</i> sp. nov.
<i>Hypoponera johannae</i> (Forel, 1891)
<i>Nesomyrmex gibber</i> Donisthorpe, 1946
<i>Ochetellus vinsoni</i> (Donisthorpe, 1946)
<i>Pheidole picata</i> Forel, 1891
<i>Pheidole tarda</i> Donisthorpe, 1947
<i>Plagiolepis madecassa</i> Forel, 1892
<i>Pristomyrmex bispinosus</i> (Donisthorpe, 1949)
<i>Pristomyrmex browni</i> Wang, 2003
<i>Pristomyrmex trispinosus</i> (Donisthorpe, 1946)
<i>Proceratium avium</i> Brown, 1974
<i>Pseudolasius dodo</i> (Donisthorpe, 1946)
<i>Solenopsis mameti</i> Donisthorpe, 1946
<i>Strumigenys agetos</i> Fisher, 2000
<i>Technomyrmex primrosae</i> Donisthorpe, 1949

MATERIALS AND METHODS

This work is based on ant inventories in Mauritius from 25 May–31 May, 2005. During that period, we visited Le Pouce Mt., Pieter Both Mt., and Calebasses Mt. in the Moka Range, and Camizard Mt., and Brise Mt. in the Bambous Range. We also collected at Basin Blanc, Ile aux Aigrettes, Cocotte Mt., and Petite Rivière Noire Mt. Ants were collected using general hand search techniques and leaf litter extraction. The work in Madagascar is based on arthropod surveys in Madagascar that included over 6,000 leaf litter samples, 4,000 pitfall traps, and 8,000 additional hand collecting events throughout Madagascar in 1992 through 2004 (Fisher 2005). The species described here was collected as part of an inventory of Réserve Spéciale d'Anjanaharibe-Sud organized by Steve Goodman (Fisher 1998).

All species and type material examined in this study have been imaged and are available on AntWeb (www.antweb.org). Material was deposited at California Academy of Sciences, San Francisco (CASC) Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts (MCZC), and British Museum of Natural History (BMNH).

Digital images (Fig. 1–17) were created using a JVC KY-F75 digital camera and Syncroscopy Auto-Montage (v 5.0) software. All metric measurements were taken at 80× power with a Leica MZ APO microscope using an orthogonal pair of micrometers and recorded to the nearest 0.001mm and rounded to two decimal places for presentation. The accuracy of the micrometers was tested against a 0.01 mm microscope micrometer before and after measurements. Measurement indices and their abbreviations used in the paper are based on those used by Ward (1988). Size and the shape of the IV abdominal segment are the most important characters for the identification and delimitation of Proceritiinae species.

List of Abbreviations Used

- HL Head length: maximum longitudinal length from the anteriormost portion of the projecting clypeus to the midpoint of a line across the back of the head.
- HW Head width: maximum width of head, including the eyes, and is taken behind them.
- CI Cephalic index: $HW/HL \times 100$.
- SL Scape length: maximum chord length excluding basal condyle and neck.
- SI Scape index: $SL/HW \times 100$.
- WL Weber's length: in lateral view of the mesosoma, diagonal length from posteroventral corner of mesosoma to the farthest point on anterior face of pronotum, excluding the neck.
- LS4 Length of abdominal sternum IV as described in Ward (1988).
- LT4 Length of abdominal tergum IV as defined in Ward (1988).
- IGR Index of gastric reflexion: $LS4/LT4$

Discothyrea berlita Fisher, sp. nov.

Fig. 1–4.

TYPE MATERIAL.—HOLOTYPE: Worker. MAURITIUS: Le Pouce Mt., Moka Range, 20°11'55"S, 057°31'44"E, 750 m, closed vegetation, 25 May 2005 (coll. B.L. Fisher et al.) Collection code: BLF12148, specimen code: CASENT0007016 (CASC).

Type worker measurements: HL 0.57, HW 0.52, CI 91, SL 0.36, SI 70, LS4 0.08, LT4 0.43, WL 0.64 IGR 0.19.

DIAGNOSIS.—The following character combination differentiates *berlita* from all its congeners: scrobe absent, fused frontal carinae projecting perpendicular to the plane of the clypeus, expanding apically, not forming a thin lamellae; propodeal angle without acute teeth or spines; anterior margin of petiole concave when viewed from above.

ETYMOLOGY.—The specific name is an arbitrary combination, to be treated as a noun in apposition.

WORKER DESCRIPTION.—Form of head, mandibles, and body as shown in Figures 1–4. Antennae 10-segmented; medium segments extremely short and not distinct when viewed with less than 100× magnification; scape expanded apically, reaching mid-point of head. Eyes with 2 or 3 facets. Without depressed scrobal area. Palpal segmentation requires dissection and thus was not determined. Mandible masticatory margin concave, with two teeth, sharp apical tooth and smaller acute basal tooth. Propodeal angle without teeth or acute angles; declivitous face of propodeum concave. Petiole thick, with lateral margins on anterior face; anterior margin concave when viewed from above. Petiole with distinct convex subpetiolar process. Abdominal segment III longer than broad.

Head and mesosoma densely punctulate; petiole sculptured as mesosoma, abdominal segment III with sparse punctures; punctures evanescent on abdominal segment IV. Integument generally opaque, except shiny for impunctate areas of metasoma.

Body, including mandible and appendages, covered with dense fine, very short whitish decumbent pubescence, becoming sparse on abdominal segment III, and dense and nearly erect on abdominal segment IV.

Color testaceous red.

DISTRIBUTION.—The single specimen was collected in a leaf litter sample in the only remaining patch of dense native vegetation near the summit of Le Pouce. Samples from other nearby mountain tops, Pieter Both (823 m), Calebasses (c.600 m), did not uncover any endemic Proceritiinae.

COMMENTS.—The African species of *Discothyrea* fall into two groups: (1) those with the

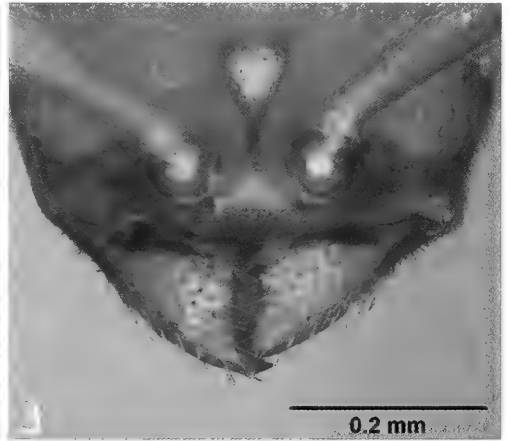
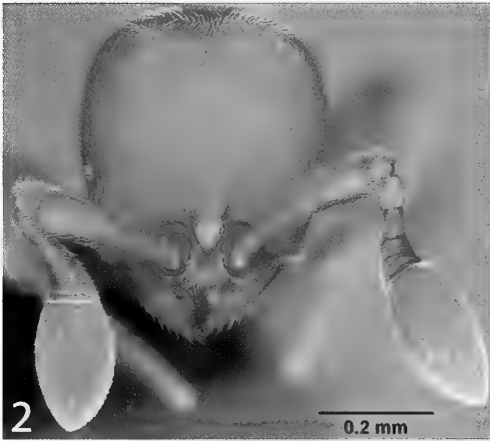
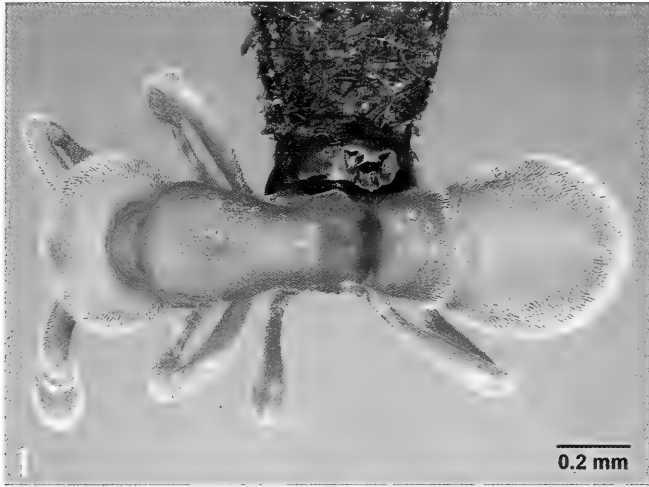


FIGURE 1-4. *Discothyrea berlita* worker: holotype CASENT0007016.

clypeo-frontal fusion flat topped and broad and with a depressed scrobe region, and (2) those in which the process forms a simple convex or angular vertical plate and lack a depressed scrobe region (Brown 1958). The *Discothyrea* of Madagascar belong to the first group. *D. berlita* is most similar to those in the second group, but is distinct in that the vertical plate does not form a thin lamella, but is expanded apically (Fig. 3).

Proceratium avium Brown, 1974

Figs. 5–13.

Proceratium avium Brown, 1974: 71, figs. 1 and 2 (worker, gyne and male). Mauritius: Le Pouce Mt, 700–800 m. Native forest, 1 Apr. 1969 (coll. W.L. Brown) [examined] AntWeb MCZTYPE32216 (MCZC) [de Andrade 2000:75]

Proceratium avioide de Andrade 2003: 78, figs 37, 38 (worker, gyne and male). Mauritius: Le Pouce Mt, 700–800 m. Native forest, 30 March 1969 (coll. W.L. Brown) [examined] AntWeb MCZTYPE35017 (MCZC).

New synonymy [see justification below]

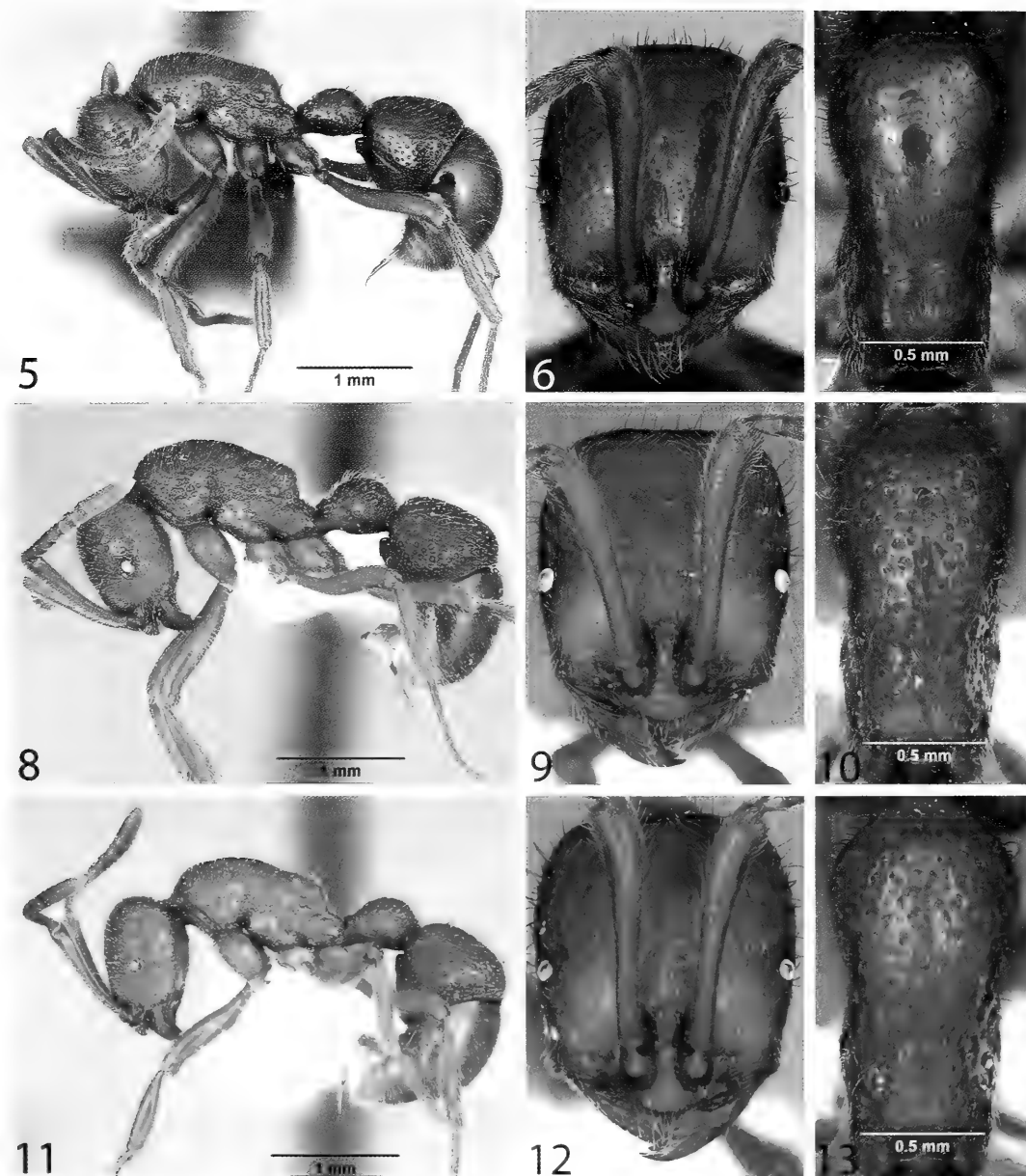
During the trip to Le Pouce on May 25 and 30, seven new collections of *Proceratium* from Le Pouce were recorded (Table 2). Because of the small size of the forest patch, only two complete colonies were collected. For the other colonies we encountered, only a few foragers were removed. As Brown (1974) observed, foragers were returning to nests with what appeared to be spider eggs. In this case, they carried the eggs in the mandible, and did not support the eggs with the recurved gaster (Brown 1980). Baroni and de Andrade (2003) suggest the recurved gaster serves a phragmotic function, but I did not observe the recurved gaster being used to plug up the ant nest entrance.

TABLE 2. Collection of *Proceratium avium* on 25 and 30 May 2005 at Le Pouce Mt., Moka Range, 20°11'55"S, 057°31'44"E, 750 m, closed vegetation.

Collection	Habitat	Caste
BLF12011	foraging on <i>Nuxia verticillata</i> with <i>Pristomyrmex bispinosus</i>	1 w
BLF12014	foraging on <i>Nuxia verticillata</i> with <i>Pristomyrmex bispinosus</i>	2 w
BLF12136	ex rot pocket, <i>Nuxia verticillata</i> , 1.5 m above ground	1 erg Q, 127 w
BLF12137	ex rot pocket, <i>Nuxia verticillata</i> , 1.5 m above ground	1 erg. 352w
BLF12139	foraging on <i>Nuxia verticillata</i> with <i>Pristomyrmex bispinosus</i>	2 w
BLF12140	foraging on <i>Nuxia verticillata</i>	8 w
BLF12142	foraging on <i>Nuxia verticillata</i>	2 w

Of note is the fact that colony (BLF12137) included 352 workers, one ergatoid queen, and no males. Based on the colony size data reported in Baroni and de Andrade (2003), this is the largest colony size recorded for *Proceratium*. Collections in May by Brown in 1969 included males. All nests encountered were located in *Nuxia verticillata* Lamark (Loganiaceae), with entrances about 1.5–2 m above ground. This tree was also the preferred nesting site for *Pristomyrmex bispinosus*. This tree, called bois maigre in Mauritius, has gnarled and twisted trunks. It is endemic to Mauritius and Reunion and appears to be the sole nesting site for *Pristomyrmex bispinosus* and *Proceratium avium*. The high winds that are common on Le Pouce abrade the twisted and intertwined trunks and branches. This action damages the tree at the contact point between intersecting branches and leads to the creation of a rot pocket and nesting site.

Three collections of *Proceratium avium* (BLF12011, 12014, and 12139) were foragers following *Pristomyrmex bispinosus*. These two species are very similar in color and general appearance. Brown in 1969 also observed this behavior. It is unclear why *Proceratium* is interspersed among the foraging workers of *P. bispinosus*. Conservation of either of these species should include further investigation of potential beneficial interactions between the species.



FIGURES 5–13 Profile, head in full-face view and mesosoma in dorsal view of *Proceratium avium* workers: Figures 5–7: CASENT0059014, BLF12136, collected May 30, 2005; Fig. 8–10: MCZTYPE32216 holotype of *Proceratium avium* collected 1 Apr. 1969; Fig. 11–13: MCZTYPE35017 holotype of *Proceratium avioide* collected 30 March 1969.

JUSTIFICATION OF SYNONYMY.— Brown (1980) collected three series of *Proceratium* at Le Pouce in 1969, one on March 30, and two on April 1. The latter were located less than 500 meters from the March 30 collecting site. He described both of these samples as *Proceratium avium* (Brown 1974). De Andrade (Baroni Urbani and de Andrade 2003) reexamined these three collec-

tions and determined that they represent two species, *P. avioide* and *P. avium*. She based this on the observation that *P. avium* differs from *P. avioide* by the less impressed sculpture, by the denser pilosity, and by longer antennal scapes (*P. avium* SI 87.3–88.6, *P. avioide* SI 81.8–83.3).

The measurements of Brown and de Andrade are not consistent, especially for the *P. avioide* material she examined. Brown noted measurements for the three collections (workers $n = 19$) as HL 0.92–0.98, HW .091–0.98, CI 96–101 SL 0.90–0.99. Brown did not calculate SI. De Andrade notes that for her *avium*: HL 1.05–1.12, HW .090–0.94, CI 84.5–85.7 SL 0.93–0.97, SI 87.3–88.6 and *P. avioide*, HL 1.10–1.16, HW .092–0.97, CI 82.1–85.1, SL 0.90–0.96, SI 81.8–83.3. Note that CI for Brown ranged from 96–101, while for De Andrade, CI ranged from 82.1–85.7.

One possible reason for these differences is the differences of HW and SL definitions. Based on the definitions presented above, I re-measured the type material using a calibrated micrometer (see Methods above). Measurements are presented in Table 3. These measurements confirm the relative differences between the Brown collections. However, when samples from the seven new collections are included, these differences become less distinct. The seven collections in the study, have even less impressed sculpture than *P. avium*, similar pilosity as *P. avium*, and longer antennal scapes than both *P. avium* and *P. avioide* (SI 98–103). Based on this study of Brown's material and the new collections in this study, I identify all these collections as one species.

The variation observed in these collections is interesting in such a small area. It is possible that because *P. avium* has ergatoid queens, and disperses presumably by budding with low dispersal ability, the complex topography of Le Pouce contributed to the observed variation. The possible restriction of the remaining population to the single forest patch at the base of the southeast peak, however, could severely limit the observed variation in the future.

Proceratium google Fisher, sp. nov.

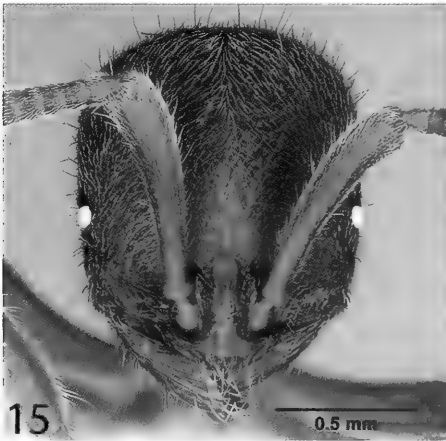
Figs. 14–17.

TYPE MATERIAL.—HOLOTYPE: Worker. MADAGASCAR: Antsiranana, 11.0 km WSW Befingotra, Réserve Spéciale Anjanaharibe-Sud, 14°45'S, 049°27'E, 1565 m, 16 Nov 1994 (coll. B.L. Fisher) sifted litter, montane rainforest, Collection code: BLF1232(6) — CASENT0100367, (CASC) PARATYPES: 2 workers with same data as holotype but with specimen codes CASENT010068 (BMNH), CASENT0100369 (MCZC); 1 worker 9.2 km WSW Befingotra, Réserve Spéciale Anjanaharibe-Sud, 14°45'S, 049°28'E, 1280 m, 5 Nov 1994 (coll. B.L. Fisher), CASENT0100370; (CASC); and 1 worker same as latter but collected at 1200 m on 9 Nov 1994, CASENT0100371 (CASC).

DIAGNOSIS.— The following character combination differentiates *P. google* from all its congeners: abdominal segment IV tergite evenly rounded posteriorly, without concave impression near apex and not hypertrophied; truncate median clypeal lobe; low nodiform petiole without peduncle but with blunt anteroventral tooth; fore tibia with a basal spine, frontal carinae separate and diverging posteriorly; posterior dorsum of mesosoma and propodeal spines granulate-foveolate. *P. google* is easily distinguished from *P. diplopyx*, the only other described *Proceratium* from Madagascar,

TABLE 3. Measurements and scape index of type material and new collections. MCZTYPE32216 is the holotype of *Proceratium avium*, MCZTYPE35017 is the holotype of *Proceratium avioide*.

Specimen number	HW	SL	SI
MCZTYPE35017	0.97	0.92	95
MCZTYPE32216	1.01	0.96	96
CASENT0055844	0.98	1.01	103
CASENT0055842	0.99	1.00	101
CASENT0059012	0.97	0.99	102
CASENT0059013	1.03	1.01	98
CASENT0059026	1.00	1.01	101
CASENT0059030	0.99	1.01	102
CASENT0059029	1.01	1.00	98
min	0.97	0.92	95
max	1.03	1.01	103



FIGURES 14-17. *Proceratium google* worker: holotype CASENT0100348.

TABLE 4. Worker measurements: maximum and minimum based on all five *Proceratium google* specimens.

Specimen CASENT #		HL	HW	CI	SL	SI	WL	LS4	LT4	IGR
0100367	Holotype	1.21	1.02	84	0.80	79	1.34	0.20	0.85	0.23
0100370	Paratype	1.24	1.07	86	0.92	86	1.49	0.18	0.79	0.23
0100371	Paratype	1.24	1.04	84	0.86	83	1.46	0.20	0.77	0.26
0100368	Paratype	1.15	1.03	89	0.84	82	1.36	0.19	0.79	0.23
0100369	Paratype	1.20	1.05	87	0.83	79	1.41	0.17	0.79	0.22
	min	1.15	1.03	84	0.83	79	1.36	0.17	0.77	0.22
	max	1.24	1.05	89	0.86	83	1.46	0.20	0.79	0.26

by the shape of the tergite of the abdominal segment IV. In *P. diplopyx*, the tergite is with a deep concave notch near apex.

ETYMOLOGY.— Named in recognition of the support from the Google company. I hope that Google will continue applying its talent to serve data relevant to the biodiversity community, conservation planners, and the general public. By creating a “Zoogle,” Google could help achieve free and democratic access to taxonomic and biodiversity data on species. *P. google* is also suspected to be a specialist egg predator of spiders, which is also why this ant is aptly named after Google—for the ability to hunt down obscure prey. The specific name is an arbitrary combination, to be treated as a noun in apposition.

WORKER DESCRIPTION.— Form of head, mandibles, and body as shown in Figures 14–17. In full-face view, posterior margin of head rounded, not concave; sides of head more or less straight medially; in profile, dorsal margin marginate. Mandible with 4 teeth. Palpal formula 4, 3. Antennae 12-segmented, scape does not reach posterior margin of head. Median clypeal lobe raised and notched medially. Eye a single, large, clear, convex facet that projects beyond the margin of the head in full-face view.

Mesosoma in dorsal view pear-shaped, broader across pronotum than across propodeum. Metanotal groove unmarked. Propodeal spines granulate-tuberculate; declivitous face of propodeum concave, ending basally with an upturned tooth. Petiole longer than wide; subpetiolar process forming an obtuse tooth at midlength. Tibial spur present on each leg. Claws on all legs slender, simple.

Abdominal segment IV tergum evenly rounded posteriorly, without concave impression near apex.

Head, mesosoma, petiole, and abdominal segment III with dense granulate-foveolate sculpture. In contrast, abdominal segment IV predominantly smooth and shiny but with sparse foveae. Declivitous face of propodeum shiny smooth.

Body covered with abundant pilosity consisting of fine, curved, tapered, yellow-white setae. Queen, male and larvae unknown.

DISTRIBUTION.— Known only from an isolated mountain in Northeastern Madagascar, Réserve Spéciale Anjanaharibe-Sud, 14°45'S, 049°27'E, collected at an elevation of 1565 m. Collections in nearby mountains such as Marojejy did not locate any specimens of this species.

CONSERVATION

Arthropods present several challenges to those dedicated to their conservation. First, they are small and inconspicuous, and thus often forgotten during the conservation planning process. Second, arthropods are overwhelmingly diverse and as a whole, barely known. Is it pragmatic to

develop a conservation strategy for a fauna we scarcely know? Third, because arthropods show a remarkable level of local endemism, they will require strategies and policies that are different from those developed to conserve birds and plants. A case in point is Mauritius.

Conservation in Mauritius is heavily biased to bird and plant preservation (Safford and Jones, 1998; Fowler et al 2000, Nicholas et al. 2004). Land management practices are tailored to benefit plants and birds, but not invertebrates. They are fighting the battle to protect the dwindling patches of native vegetation and bird populations. For plants, this includes the establishments of Conservation Management Areas where alien plants are manually removed (Dulloo et al 2002). In these plots, weedy vegetation is removed up to three times a year. The active removal of large number of weedy plants, however, creates large areas of bare soil and understory (Dulloo et al 2002, pers. obs.). This disturbance facilitates the establishment of invasive ants, at the expense of any remaining native ants (pers. obs.).

The small, one-hectare patch of native forest left on Le Pouce could be destroyed for native ants if an active weeding program is initiated. The closed vegetation is essential for the survival of the endemic *Discothyrea*, *Pristomyrmex*, and *Acropyga*, which thrive in the cold, moist understory. With weeding and increased insolation and disturbance, the invasive ants that surround this small patch would quickly move in and destroy this ant sanctuary.

An alternative approach to the manual weeding strategy would be to plant native trees around this patch, including *Nuxia verticillata*, which is home to *Proceratium* and *Pristomyrmex*. The goal would be to create a dense closed canopy of natives around this patch without disturbing the patch itself. Over time, the effective size of this patch could expand. We also advise that future collections of endemic ants in Mauritius avoid collecting entire colonies.

Mauritius has shown that once invasive ants take hold, there is almost no way to return the land to native ants and healthy arthropod communities (pers. obs.). Therefore, in Madagascar, land managers must monitor for invasive arthropods. Even though remnant patches of forest may be preserved, invasion by aggressive exotic ants may drive native ants locally extinct. One of the simplest and most effective methods is to track the presence or absence of invasive ants. In this approach, targeted collecting can be performed in habitats and microenvironments most likely to harbor invasives.

ACKNOWLEDGMENTS

This work was supported by the National Science Foundation under Grant No. DEB-0344731 to B.L. Fisher and P.S. Ward. Fieldwork that provided the basis for this work could not have been completed without the support of Lorch Lach, Andy Suarez, and Vikash Tatayah from the Mauritian Wildlife Foundation. I am also grateful for the Arthropod Inventory Team (Balsama Rajemison, Jean-Jacques Rafanomezantsoa, Chrislain Ranaivo, Coco Randriambololona, Hanitriniana Rasoazanamavo, Nicole Rasoamanana, Clavier Randrianandrasana, Valerie Rakotomalala, and Dimby Raharinjanahary) who helped collect and process this material. I thank April Nobile for creating the images.

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**A New Species of Deepwater Snake Eel,
Ophichthus pullus (Anguilliformes: Ophichthidae),
from Angola and Guinea-Bissau**

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Ophichthus pullus, a new species of snake eel, subfamily Ophichthinae, is described from specimens trawled in deep water (106–154 m) off Angola and Guinea-Bissau. It is most similar to *Ophichthus aphotistos* from Taiwan and *O. cruentifer* from the western Atlantic but differs from them and other elongate, deepwater species of *Ophichthus* in its vertebral number (149–153), snout condition, pectoral-fin shape and size, and dark coloration.

KEY WORDS: Ophichthidae; *Ophichthus pullus* sp. nov.; Angola, Guinea-Bissau; *Ophichthus aphotistos*; *Ophichthus cruentifer*; snake eels.

Recent deepwater assessment cruises off the eastern tropical Atlantic by the R/V Dr. Fridtjof Nansen have uncovered a new species of snake eel, genus *Ophichthus*, of the ophichthid subfamily Ophichthinae (*sensu* McCosker 1977). The Nansen specimens were made available to a group of ichthyologists that met at an FAO workshop in Tenerife, Canary Islands, during July 2004. The specimens had been frozen and thawed, and although somewhat tawdry, they were ultimately recognized by the author as an undescribed species. Tomio Iwamoto returned to Angola aboard the Nansen in April 2005 and saved two superb specimens of the new species. In order that the name of that eel become available for the upcoming publication of the FAO *Living Marine Resources of the Eastern Central Atlantic* (Kent Carpenter, editor), I herein describe the new species and compare it to the closely related deep-water ophichthines *Ophichthus aphotistos* and *O. cruentifer*.

Most ophichthids occupy habitats shallower than 100 m, ranging from coral reefs to sand and mud substrates, entering rivers and estuaries. Recent deep-water trapping, trawling, and submersible captures of ophichthids have uncovered a number of new species living at depths as great as 1300 m (McCosker et al. 1989; McCosker 1999; McCosker and Chen 2000). Although most ophichthids are undesirable as a human protein source, they are readily consumed by other fishes and their role in marine ecosystems is poorly understood. It is likely that additional species will be discovered as a result of ongoing deepwater ichthyological surveys.

MATERIALS AND METHODS

Measurements are straight-line, made either with a 300 mm ruler with 0.5 mm gradations (for total length, trunk length, and tail length), and recorded to the nearest 0.5 mm, or a 1 m ruler with 1 mm gradations and recorded to the nearest 1 mm. All other measurements are made with dial calipers or dividers and recorded to the nearest 0.1 mm. Body length is head plus trunk length.

Head length is measured from the snout tip to the posterodorsal margin of the gill opening; trunk length is taken from the end of the head to mid-anus; maximum body depth does not include the median fins. The jaw rictus of the paratypes were surgically cut on the right side to allow the accurate examination of dentition, a necessary procedure. Head pore terminology follows that of McCosker et al. (1989:257) and McCosker and Chen (2000). Vertebral counts (which include the hypural) were taken from radiographs. The mean vertebral formula (MVF) is expressed as the average of predorsal, preanal, and total vertebrae. Type specimens are deposited at the California Academy of Sciences, San Francisco (CAS). Institutional abbreviations follow the Standard Symbolic Codes for Institutional Research Collections in Herpetology and Ichthyology (Leviton et al. 1985).

Genus *Ophichthus* Ahl, 1789

Ophichthus Ahl, 1789: 5 (type species *Muraena ophis* Linnaeus 1758, by original designation).

Ophichthus pullus McCosker, sp. nov.

(Figs. 1–3; Table 1)

MATERIAL EXAMINED.— HOLOTYPE: CAS 222666, 451 mm TL, a ripe male, from Angola (12°24'S, 13°22'E), 106–107 m, otter trawl, *R/V Dr. Fridtjof Nansen*, Sta. 3608, between 1604–1634 on 1 Aug. 2005. PARATYPE: CAS 222667, 529 mm TL, a ripening female, from Angola (07°04'S, 12°00'E), 150–154 m, otter trawl, *R/V Dr. Fridtjof Nansen*, Sta. 3767, between 1615–1645, on 20 Aug. 2005. NONPARATYPE: unnumbered specimen, Centro Oceanográfico de Canarias, Tenerife, 534 mm TL, a ripe male, from Bissau, precise locality and depth unknown.

DIAGNOSIS.— A moderately elongate species of *Ophichthus* with: tail 57–61%, head 8.5–8.9%, and body depth at gill opening 2.8–3.3% of total length; dorsal-fin origin well behind pectoral-fin tips; pectoral fin rounded, not elongate and well-developed; posterior nostril a hole above the upper lip, covered by a flap that extends to or below the edge of the mouth; upper lip lacks barbels between anterior and posterior nostrils; pores small but conspicuous, SO 1 + 4, IO 4 + 2, POM 6 + 2; teeth small and conical, biserial on anterior vomer and jaws; coloration uniform gray-brown to nearly black; total vertebrae 149–153, mean vertebral formula 20.3-56.3-151.3.

COUNTS AND MEASUREMENTS OF THE HOLOTYPE (in mm).— Total length 451; head 38.5; trunk 138.5; tail 274; predorsal distance 65; pectoral-fin length 9.6; pectoral-fin base 4.05; body depth *ca.* 12.5 at gill openings; body width *ca.* 12.0 at gill openings; body depth at anus *ca.* 15; body width at anus *ca.* 14.5; snout 6.7; tip of snout to rictus 11.0; eye diameter 3.25; interorbital width 5.4; gill opening height 5.25; isthmus width 6.6. Vertebral formula 18-55-149.

DESCRIPTION.— Body moderately elongate, subcircular to level of anus, then becoming more compressed, its depth at gill openings 30–36 in TL. Branchial basket moderately expanded. Head 3.6–3.8 in trunk. Head and trunk 2.3–2.6 and head 11–12 in TL. Snout rounded, moderately acute when viewed from above; a short groove bisecting underside of snout nearly to tip of upper jaw; snout, lips and chin densely covered with minute sensory papillae. Lower jaw included, its tip reaching beyond anterior base of anterior nostril tube. Upper jaw not elongated, rictus behind a vertical from posterior margin of eye. Eye not enlarged, 3.2–3.6 in upper jaw and 10.1–11.9 in head. Anterior nostrils tubular, extending ventrolaterally from snout at *ca.* 20°, reaching below upper lip but not reaching tip of chin when directed forward. Posterior nostril a hole above upper lip, covered by a flap that extends below the edge of mouth. There are no barbels along upper lip between the anterior and posterior nostrils. Dorsal-fin origin begins well behind pectoral fin about a head length into trunk length. Median fins low but obvious, ending in a shallow groove a little more than

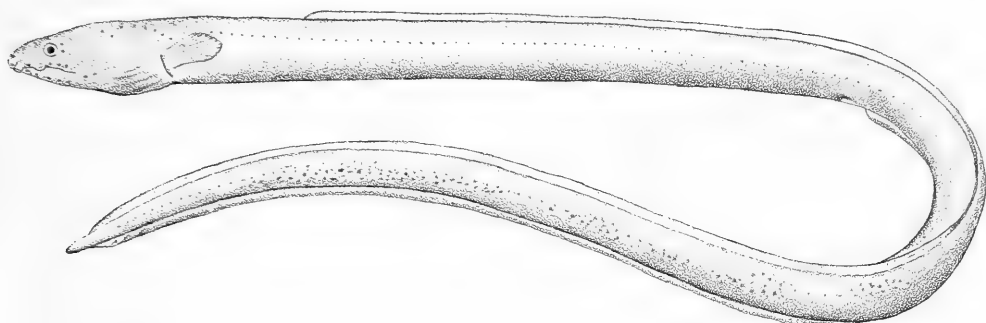


FIGURE 1. Holotype of *Ophichthus pullus* sp. nov., CAS 222666, male, 451mm.

2 eye diameters before the bluntly pointed tail tip. Pectoral fins rounded, not elongate and lanceolate.

Head pores identical in position and number for all specimens, small but apparent (Fig. 2). Single median interorbital and temporal pores. Supraorbital pores 1 + 4, infraorbital pores 4 + 2, lower jaw pores 6, preopercular pores 2, supratemporal pores 3. Faint rows of sensory papillae are visible along the nape and beneath and behind the mandible. Lateral-line pores apparent; 8 before gill opening in a high arching sequence, 54–55 before anus, 143–145 total, the last ca. the distance of the snout from the tail tip.

Teeth (Fig. 3) small, conical, slightly retrorse. One central and 2 on each side at tip of snout, followed by an intermaxillary rosette of about 5 irregular pairs of teeth, followed by a single row of 8–9 small vomerine teeth, decreasing in size posteriorly. Maxillary with about 6–9 pairs of subequal irregularly biserial teeth, followed by 3–5 uniserial teeth. Lower jaw with about 4–6 pairs of irregularly subequal biserial teeth, followed by 13–18 uniserial teeth.

Color in ethanol uniform gray-brown to black. An irregular pattern of fine black specks equal in size to lateral-line pores along dorsal and ventral surface of trunk and tail. Inner margins of lips pale, with a fine black line extending from beyond eye to rictus. Median fins basally pale. Anterior nostrils, tail tip, anal opening, lateral line and cephalic pores, and margin of median fins pale. Posterior pectoral fin margin pale. Peritoneum pale. Inside of mouth pale, densely speckled with dark brown flecks.

SIZE.— The largest known specimen was 585 mm TL. It was trawled from off Angola, frozen and thawed and in very poor condition and ultimately discarded.

ETYMOLOGY.— From the Latin *pullus*, dark-colored, in reference to its appearance.

DISTRIBUTION.— Known from the type series, from 106–154 m depth, collected from off Angola and Guinea-Bissau.

REMARKS.— The new species appears to be very closely related to the deepwater snake eels

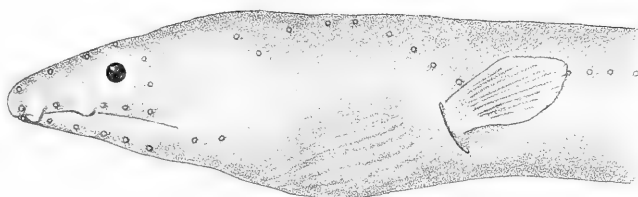


FIGURE 2. Head of holotype of *Ophichthus pullus* sp. nov., CAS 222666, male, 451mm.

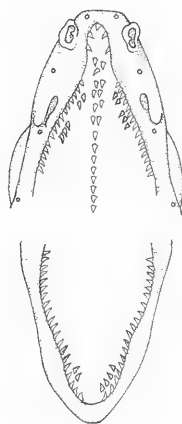


FIGURE 3. Dentition of holotype of *Ophichthus pullus* sp. nov., CAS 222666, male, 451 mm.

Ophichthus aphotistos McCosker and Chen (2000) from Taiwan and *O. cruentifer* (Goode and Bean 1896) of the eastern Atlantic. They are nearly identical in body shape and proportions, physiognomy, pore conditions, and dentition, and are very similar in their dorsal-fin origin, pectoral-fin condition, and coloration. *Ophichthus pullus* differs from *O. aphotistos* and *O. cruentifer* in the length of its lower jaw; when closed, the lower jaw of the new species extends beyond the bases of the anterior

nostril tubes, whereas that of the other species either falls short or does not exceed the bases of those tubes. The dentition of the new species is similar in appearance, location, and number to that of *O. cruentifer* (see McCosker et al. 1989: fig. 395), but differs from that of *O. aphotistos* (see McCosker and Chen 2000: fig. 3). Whereas the jaw teeth of *O. pullus* are biserial anteriorly and uniserial posteriorly, those of most *O. aphotistos* are biserial throughout. This however may be related to the size of the specimen in that the smallest paratype (480 mm TL) of *O. aphotistos* also has uniserial maxillary dentition posteriorly (McCosker and Chen 2000: 354–355). *Ophichthus pullus* further differs from *O. aphotistos* (Table 1) in having a shorter head, slightly more posterior dorsal-fin origin, a shorter and blunter snout, a shorter pectoral fin (paddle-shaped rather than lanceolate), and fewer vertebrae. *Ophichthus pullus* further differs from *O. cruentifer* (Table 1) in having a longer head, a slightly more posterior dorsal-fin origin, a generally smaller eye, a shorter and blunter snout, a shorter and broader pectoral fin, and a darker coloration (uniform tan to grayish brown, rather than dark gray to black). *Ophichthus pullus* attains a larger size than does *O. cruentifer*; the known specimens of *O. pullus* range from 451–585 mm TL, whereas the largest of 84 specimens of *O. cruentifer* examined by Wenner (1976) was 423 mm TL and the largest of 80 specimens examined by McCosker et al. (1989) was 467 mm TL. *Ophichthus cruentifer* occupies depths similar to that occupied by the new species, and *O. aphotistos* has been captured by trawl over sand and muddy substrates between 36–1350 m (McCosker et al. 1989), and was observed from submersibles by Wenner (1976) to be most abundant between 250–350 m, with only their heads exposed over sandy substrates or resting on the sediment with their bodies in S-shaped curves.

The new species was also compared to specimens and descriptions of other elongate Indo-Pacific species of *Ophichthus*. The deepwater (235–490 m) western Indian Ocean *O. serpentinus*

TABLE 1. Counts and proportions (in thousandths) of the holotype, paratype, and nonparatype of *Ophichthus pullus* as compared to three specimens of *O. aphotistos* (from McCosker and Chen 2000) and 10 specimens of *O. cruentifer* (from McCosker et al. 1989). (TL = total length, HL = head length.)

	<i>O. pullus</i>		<i>O. aphotistos</i>	<i>O. cruentifer</i>
	Mean	Range	Range	Range
TL (mm)	—	451–529	480–628	249–428
HL/TL	88	85–89	77–81	69–87
Head and trunk/TL	415	392–427	396–406	380–430
Tail/TL	585	573–608	594–604	570–620
Depth/TL	30	28–33	25–29	23–30
DFO/TL	175	144–191	123–148	95–160
PF length/HL	237	226–249	208–326	238–306 ¹
Upper jaw/HL	317	286–343	311–324	290–370
Snout/HL	183	174–188	204–216	200–230
Eye/HL	92	84–99	94–106	56–92
Predorsal vertebrae	20	18–23	16–19	14–19 ²
Preanal vertebrae	56	55–58	58–60	56–61 ³
Total vertebrae	151	149–153	158–162	144–155 ⁴

¹ These data reflect the removal of an irregular specimen that was previously included in McCosker and Chen (2000: table 1); ² n=33; ³ n=31; ⁴ n=48

Seale (1917) is similar in elongation and appearance, but has more vertebrae (163–167) and uniserial mandibular teeth. *Ophichthus pullus* is also similar in appearance to *Ophichthus exourus* McCosker (1999), a deepwater (450–520 m) species from New Caledonia and Fiji, which differs in having uniserial mandibular teeth and more vertebrae (176–177). *Ophichthus brachynopterus* Karrer (1982), known from three deepwater (355–428 m) specimens from NE Madagascar, has similar but more irregular biserial dentition, a much larger eye, a more posterior dorsal-fin origin (above the 27th–31st vertebrae), and more vertebrae (178).

Various subgeneric lineages can be identified within *Ophichthus* (sensu lato), and a comprehensive examination of the more than 55 valid species may result in the elevation of several subgenera to generic status (McCosker 1977; McCosker et al. 1989). Based on current knowledge, the new species and its relatives *O. aphotistos* and *O. cruentifer* would reside in *Omochelys* (Fowler 1918, originally described as a subgenus of *Pisodonophis*), type species *Pisodonophis cruentifer* Goode and Bean (1896).

COMPARATIVE MATERIAL EXAMINED.— *Ophichthus aphotistos*, CAS 209192, 580 mm TL (holotype), and USNM 356862, 628 mm TL, and NSYSU 3657, 480 mm (paratypes). *Ophichthus brachynopterus*, MNHN 1979-22, 442 mm TL, and 413 mm TL (MNHN 1979-23, 413 mm TL (paratypes). *Ophichthus cruentifer*, USNM 28938, 415 mm TL (lectotype), and 80 additional specimens 67–467 mm, as listed in McCosker et al. (1989: 386). *Ophichthus exourus*, MNHN 1995-425, 520 mm (holotype), and CAS 89552, 429 mm (paratype). *Ophichthus serpentinus*, MCZ 9200, 495 mm, holotype.

ACKNOWLEDGMENTS

I wish to thank Tomio Iwamoto for collecting the type specimens; Kent Carpenter, Michel Lamboeuf, and Pere Oliver for inviting my participation in the FAO workshop; Eduardo Balguerías Guerra for assistance during the FAO workshop; Beth Herd Guy for preparing the illustrations; the late Eugenie Böhlke (Academy of Natural Sciences, Philadelphia [ANSP]), and the staffs of the California Academy of Sciences (CAS), Museum of Comparative Zoology, Harvard University (MCZ), Muséum National d'Histoire Naturelle, Paris (MNHN), and the National Museum of Natural History (NMNH), Washington D.C., for advice and assistance with specimens; Alan Leviton for his patience and assistance; Tomio Iwamoto for reading a draft of this manuscript; and the volume editors, who caught a few unpardonable goofs in the typescript.

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Two New Species of Melastomataceae from Southern Mesoamerica

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Two new species of Melastomataceae, *Blakea venusta* (Blakeeae), endemic to Costa Rica, and *Miconia dissitinervia* (Miconieae), restricted to Costa Rica and Panama are described and illustrated. *Blakea venusta* is distinguished by its epiphytic, pendent habit, copious indument of spreading reddish-brown hairs, and paired leaves at a node that are commonly dimorphic in size. *Miconia dissitinervia* is characterized by a calyx that is fused in bud but ruptures at anthesis into irregular hyaline lobes. Distributional and phenological notes are provided together with diagnostic illustrations, photographs taken in the field, and keys to separate these species from their presumed closest relatives.

Resumen

Dos nuevas especies de Melastomataceae, *Blakea venusta* (Blakeeae), endémica de Costa Rica, y *Miconia dissitinervia* (Miconieae) restringida a Costa Rica y Panamá son descritas e ilustradas. *Blakea venusta* muestra un carácter vegetativo poco común en el género, sus hojas fuertemente dimórficas en tamaño por nudo; *Miconia dissitinervia* por otro lado, presenta un carácter del andróceo que comparte con pocos congéneres, su caliz fusionado en botón y que se rompe en antésis en lóbulos irregulares hialinos. También se incluyen notas sobre distribución y fenología, así como fotografías y claves para separar las especies de sus parientes más cercanos.

Two new species of berry-fruited Melastomataceae, *Blakea venusta* and *Miconia dissitinervia*, are described from Costa Rica and Panamá in the Mesoamerican biodiversity hotspot (Mittermeier et al., 1999; Mittermeier et al. 2004). Description of a new *Blakea* now brings the number of Mesoamerican species in that genus to 34, over 75% of which are restricted to Costa Rica and Panamá (Almeda 2000a). Addition of another species of *Miconia* brings the total number of species in that genus for the Mesoamerican region to 163, 127 of which are also known only from Costa Rica and Panamá. Almeda (2000a, 2000b) commented on the importance of this southern Mesoamerican area as a secondary center of diversity for both of these genera and predicted that additional taxa would come to light as remote areas were explored. Discovery of the two species described here suggests that continued exploration of readily accessible collecting sites throughout the year will continue to yield new and noteworthy taxa.

***Blakea venusta* Kriebel, Almeda & Estrada, sp. nov.**

Figs. 1, 2D.

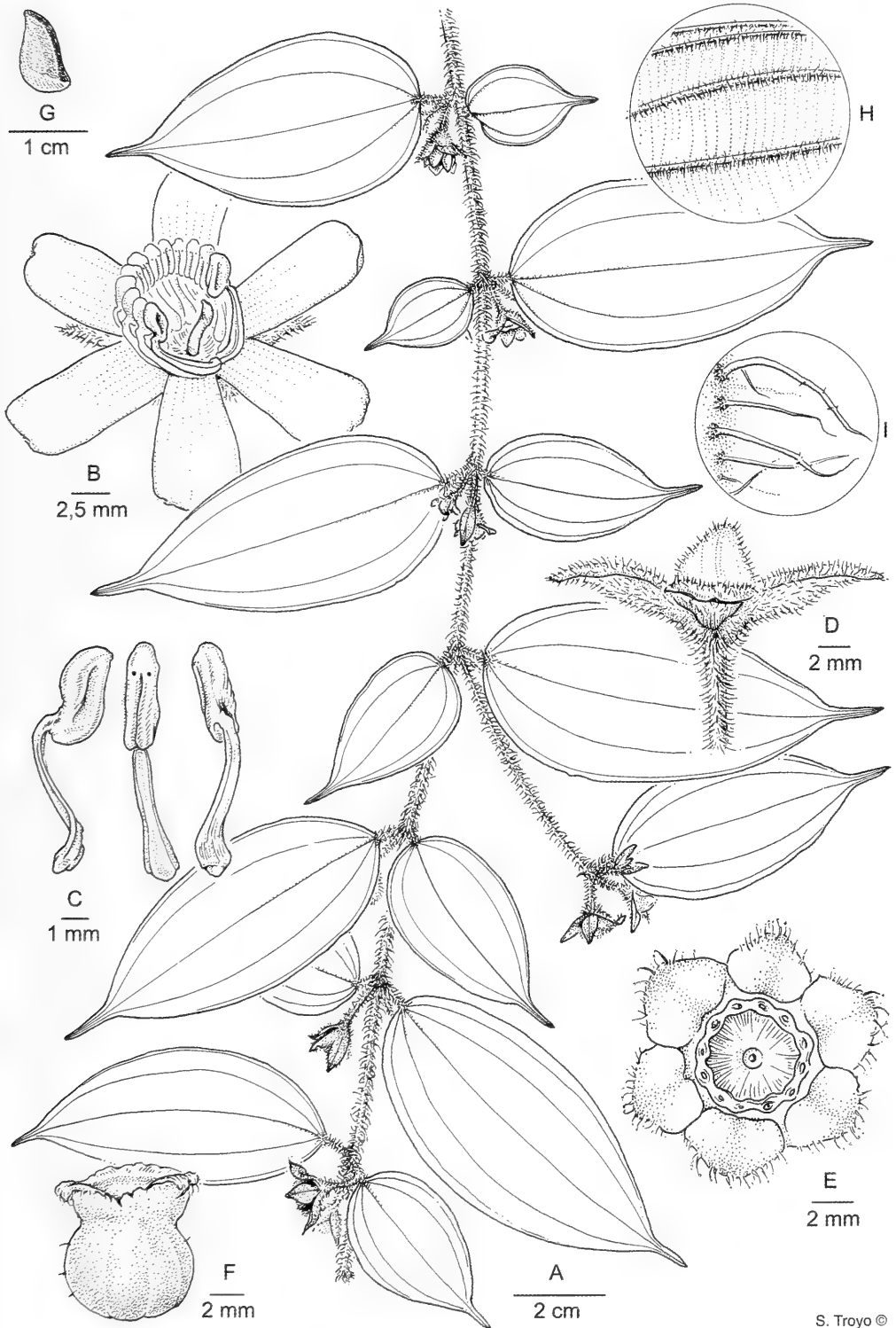
TYPE.— COSTA RICA: **San José:** Pérez Zeledón, Cordillera de Talamanca, Carretera Interamericana km 115-116, bosque primario y secundario a la par del camino entre División y Hortensia, 9°28'40", 83°41'25", 1750 m, 12 Nov. 2003 (fl, fr), *R. Kriebel & D. Solano 4081* (Holotype: INB!; Isotypes: CAS!, CR!, MO!).

Frutex epiphyticus. Ramuli sicut petioli, folia subtus pedunculi setosi 1–3.5 mm longis induti. Folia in quoque pari dimorpha chartacea integra apice caudato-acuminata basi obtusa vel rotundata. Folia maiora: lamina 5–9.9 × 2.6–5.2 cm lanceolato-ovata, elliptica vel elliptico-ovata, 5-nervata. Folia minora: lamina 1–4 × 1–2.4 cm, ovata vel suborbiculata, 3-nervata. Flores 6-meri in quoque nodo 1–3; pedunculi 3–12 mm longis; bractae omnino liberae; bractae exteriores 7–15 × 2.5–4.5 mm, lanceolatae vel elliptico-lanceolatae; bractae interiores 5–11 × 4–6 mm, ovato-lanceolatae. Calycis tubus 1–1.5 mm longus, lobis 1.5–2.5 × 3.5–4.5 mm. Petala 13–17 × 5–7 mm oblonga. Antherarum thecae 4 × 2 mm oblongae inter se cohaerentes apice minute biporosae; connectivum nec prolongatum nec appendiculatum. Ovarium 6-loculare, omnino inferum, apice papilloso.

Epiphytic shrub with sprawling, subscaudent or pendent branchlets. Young vegetative buds, internodes, petioles, abaxial foliar surfaces, floral peduncles and bracts densely setose with simple, basally barbed reddish-brown hairs, 1–3.5 mm long. Leaves at a node slightly unequal to generally very unequal in length, somewhat dimorphic to isomorphic in shape, chartaceous, sparsely villose to glabrous adaxially, apex caudate-acuminate, base obtuse to rounded, margin entire. Large leaves at a node: blade 5–9.9 × 2.6–5.2 cm, lanceolate-ovate, elliptic, elliptic-ovate or elliptic-oblong, 5-nerved; petioles 2–7 mm long. Small leaves a node: blade 1–4 × 1–2.4 cm, broadly lanceolate, ovate or suborbicular, 3-nerved; petioles 0.5–5 mm. Flowers spreading but not pendent, frequently hidden under subtending leaves, 1–3 flowers in each leaf axil; peduncles 3–12 mm long. Floral bracts foliaceous, all free from one another, typically longer than the hypanthium proper in length, adaxially moderately covered with spreading basally barbed hairs, margin entire; outer bracts 7–15 × 2.5–4.5 mm, lanceolate to elliptic-lanceolate, apex acuminate, with a somewhat conspicuous midvein; inner bracts 5–11 × 4–6 mm, ovate-lanceolate, apex acute. Calyx tube 1–1.5 mm long; free portions of the calyx lobes 1.5–2.5 mm long and 3.5–4.5 mm wide, broadly deltoid to rounded-deltoid, with each lobe terminating in a blunt reflexed callose thickening, margin entire and beset with gland-tipped hairs, the adaxial surface papillose and strigillose with barbellate hairs especially towards the apex, abaxial surface sparsely papillose and strigillose with roughened hairs grading into stellate hairs basally. Petals 6, 13–17 × 5–7 mm, white, oblong, obliquely rounded apically, entire and sparsely beset with gland-tipped hairs. Stamens 12; staminal filaments 6.5–8.5 mm long, declined to one side of the flower opposing the style, white, inconspicuously flushed with pink basally; anthers 4 × 2 mm, yellow, laterally connate for practically their entire length, oblong and somewhat arcuate in dorsal view, laterally compressed, the two pores positioned 0.5–0.75 mm below the apex of the anther on the ventral face, connective simple. Ovary 6-locular, papillose and truncate apically. Style erect and somewhat incurved distally, 8.5–9.5 mm long, glabrous, distal half white and basal half pink; stigma punctiform. Berry globose, 8–10 × 6–8 mm, moderately to sparingly stellulate-furfuraceous. Seeds mostly 1 mm long, beige, narrowly pyriform.

DISTRIBUTION AND PHENOLOGY.— A local species presently known only from Costa Rica where it occurs in cloud forests at 1300–1750 m on the Pacific slope of the Cordillera de

FIGURE 1 (right). *Blakea venusta* Kriebel, Almeda & Estrada. A. habit; B. fully expanded flower; C. representative stamens; D. hypanthium with subtending floral bracts, (one inner bract, petals, style, and stamens removed); E. top view of young fruit showing stylar scar, toral ring, and calyx lobes; F. berry; G. representative seed; H. enlargement of primary foliar veins (abaxial surface); I. enlargement of indument on cauline internodes. (A-I from *Kriebel & Solano 4081*.)



Talamanca. *Blakea venusta* is common to abundant at both of its known localities and grows sympatrically with other rare species of Melastomataceae such as *Clidemia davidsei* Almeda, *Blakea wilsoniorum* Almeda, *Henriettella trachyphylla* Triana, *Miconia cremadena* Gleason and *M. costaricensis* Cogn. Collected in flower and fruit in September and November; also with fruits in June.

PARATYPES.—COSTA RICA: **San José:** Pérez Zeledón, Cordillera de Talamanca, Carretera Interamericana, km 115–116, bosque primario y secundario a la par del camino entre División y Hortensia, 9°28'40", 83°41'25", 1750 m, 3 June 2003 (fr), *Kriebel & Hammel 3340* (CAS, CR, INB, MO); Pérez Zeledón, Cordillera de Talamanca, P.N. Chirripó, Estación Santa Elena, colectado a orilla de río y potrero, 9°23'36", 83°35'21", 1300–1400 m, 17 Sep. 1997 (fl, fr), *Alfaro 1420* (CR, INB, MO).

Blakea venusta is readily recognized by its dense setose indument of simple, basally barbed reddish-brown hairs 1–3.5 mm long on young vegetative buds, internodes, petioles, abaxial foliar surface, floral peduncles and bracts, leaves that are strongly dimorphic in size at each node, short pedunculate flowers, calyx lobes and petals marginally beset with gland-tipped hairs, and anthers laterally connate for practically their entire length. In the most recent key to species of *Blakea* in Mexico and Central America (Almeda, 2000a), *B. venusta* keys to couplet 12 next to *B. guatemalensis* and *B. foliacea*, clearly its presumed closest relatives on the basis of foliar dimorphism, inner and outer floral bracts that are free to the base, and laterally connate anthers. The three species can be distinguished by the following key:

1. Uppermost internodes, young vegetative buds, and floral peduncles densely to moderately covered with a scurfy paleaceous indument intermixed with or sometimes replaced by ± flattened, roughened hairs or varying to nearly glabrous with age; leaf blades either subpeltate or bearing domatia; peduncles 1.2–5.7 cm; calyx lobe and petal margin lacking glandular hairs; connective dorsally appendaged
 2. Leaf blades subpeltate at the base, lacking inconspicuous domatia in the angles between the median vein and each of the two innermost veins on the abaxial surface
..... *B. guatemalensis* Donn. Sm.
 - 2'. Leaf blades not subpeltate at the base, inconspicuous domatia (these often ruptured) typically formed in the angles between the median vein and each of the two innermost veins on the abaxial surface *B. foliacea* Gleason
- 1'. Uppermost internodes, young vegetative buds, and floral peduncles densely covered with simple, basally barbed reddish-brown hairs 1–3.5 mm long; leaf blades neither subpeltate nor bearing domatia; peduncles 0.3–1.2 cm; calyx lobe and petal margin sparsely beset with glandular hairs; connective unappendaged *B. venusta* Kriebel, Almeda & Estrada

***Miconia dissitinervia* Kriebel, Almeda & Estrada, sp. nov.**

Figs. 2A–C, 3.

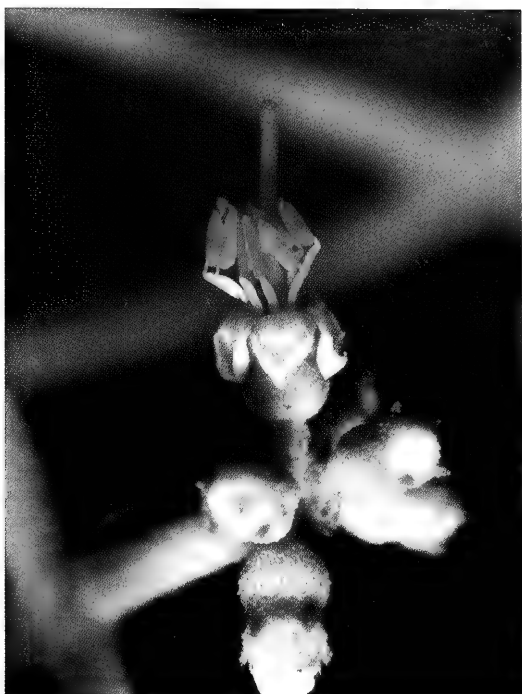
TYPE.—COSTA RICA: **San José:** Turrubares, San Juan de Mata. Area no protegida. Lajas. 9°42'20"N 84°35'13"W, elev. 600 m, 26 Nov. 1983, *A. Estrada et. al. 3101* (Holotype: CR!; Isotypes: CAS!, INB!, MO!).

Section *Amblyarrhena*. Frutex vel arbuscula 1–5 m altus. Ramuli obscure quadrangulati sicut petioli folia subtus inflorescentia hypanthiaque dense stellatis induti. Petioli 1.5–2.5 cm longi; lam-

FIGURE 2 (right). *Miconia dissitinervia* Kriebel, Almeda & Estrada. A. habit showing inflorescence; B. close-up of fully expanded flower showing reflexed petals; C. representative leaf showing abaxial surface; D. *Blakea venusta* Kriebel, Almeda & Estrada, fully expanded flower showing declinate semicircle of connate anthers. (A–C from live material of *Kriebel et al. 5046*; D from live material of *Kriebel & Solano 4081*.)



A



B



C



D

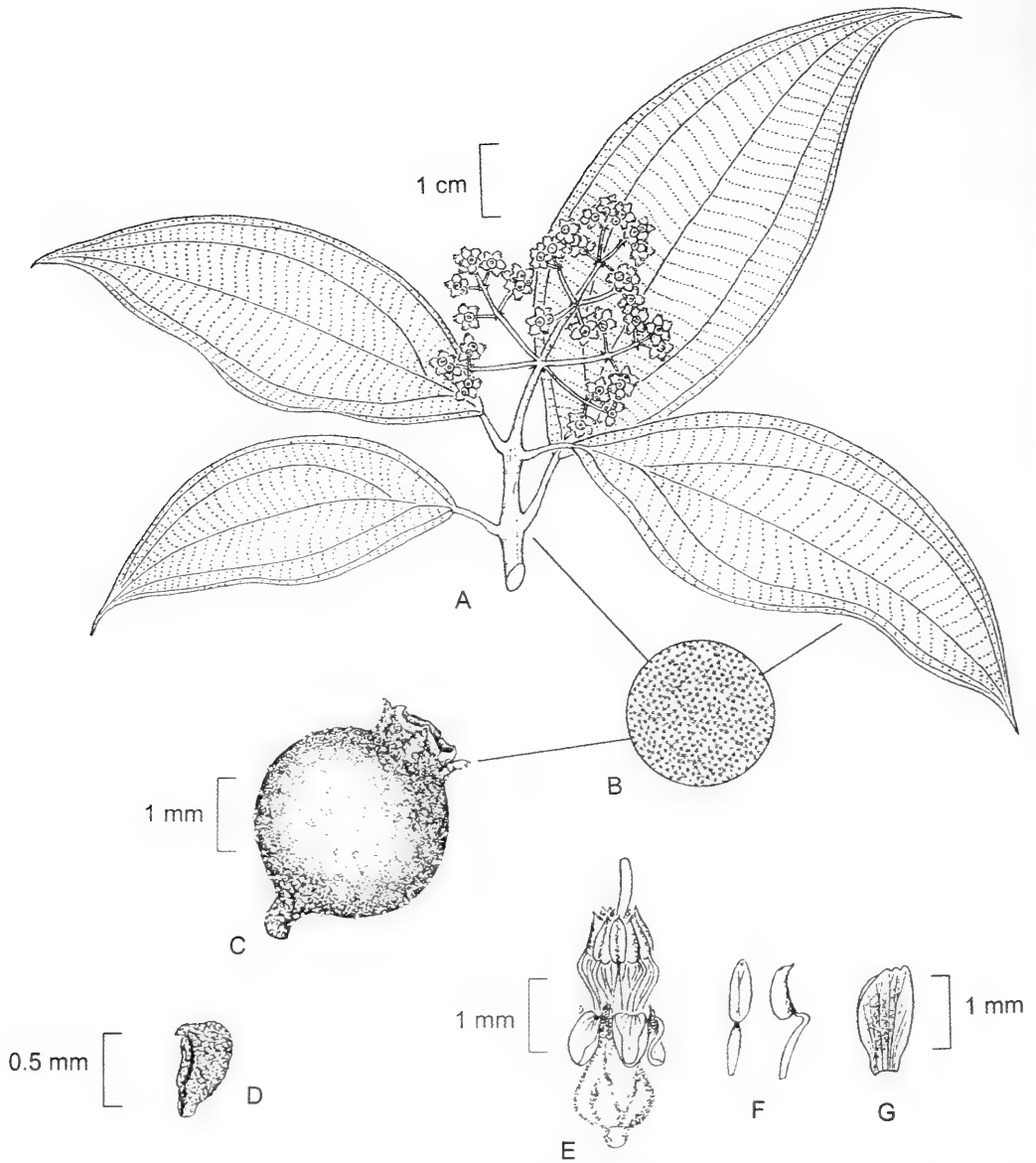


FIGURE 3. *Miconia dissitinervia* Kriebel, Almeda & Estrada. A. habit with infructescence; B. enlargement of stellate indument on foliar and hypanthial surfaces; C. berry; D. representative seed; E. fully expanded flower; F. stamens, ventral view (left) and profile view (right); G. representative petal, adaxial surface. (A-G from Aguilar 4977.)

ina 10–35 × 5–15 cm elliptica vel elliptico-ovata, 3–5-plinervata. Panicula 8–10 cm longa multiflora; flores 5-meri, pedicellis (ad anthesim) 0.25–0.5 mm longis, bracteolis 1 mm longis. Hypanthium (ad torum) 2 mm longum; calyx primum in cono apiculato clausus demum in lobos irregulares persistentes ruptus, dentibus exterioribus 0.15–0.25 mm eminentibus. Petala ca. 2 × 1 mm oblonga papillosa. Stamina isomorphica glabra; filamenta 1.5 mm longa; antherarum thecae 1 × 0.4 mm angustae oblongae, poro ventraliter inclinato; connectivum nec prolongatum nec appendiculatum. Stylus 3–4 mm glaber; ovarium 5-loculare et omnino apice glabro.

Shrub to small tree 1–5 m tall; uppermost branchlets, vegetative buds, petioles, lower leaf-surfaces, inflorescences, bracts, bracteoles, and hypanthia completely covered with an indument of stellate hairs. Leaves of a pair equal to unequal in size; petioles 1.5–2.5 cm long; leaf-blades 10–35 × 5–15 cm, chartaceous, elliptic (sometimes broadly so) to elliptic-ovate, margin entire to inconspicuously crenulate, apex acuminate to long-acuminate, base acute to long-attenuate, 3–5-plinerved (excluding the ill-defined inframarginal pair) with the inner pair of primary subparallel veins diverging from the median vein in alternate or subalternate fashion. Inflorescence a terminal multiflowered panicle 8–10 cm long; bracts and bracteoles linear, 1–2 × 0.25–0.5 mm, caducous; pedicels 0.25–0.5 mm long. Hypanthia (at anthesis) urceolate, 2 mm long to the torus; calyx tube 0.25 mm long; calyx fused in bud but rupturing irregularly at anthesis into 2–5 persistent hyaline lobes; calyx teeth 0.15–0.25 mm long, narrowly triangular. Petals 5, ca. 2 × 1 mm, papillose adaxially, white, oblong, rounded to emarginate apically, conspicuously reflexed at anthesis. Stamens 10, isomorphic; filaments glabrous, complanate, 1.5 mm long; anthers 1 × 0.4 mm, yellow, linear-oblong, apiculate at the apex, laterally compressed and deeply ventrally channeled between the thecae ventrally, 2-celled, the single pore ventrally inclined; connective simple, neither prolonged nor appendaged. Ovary 5-locular, completely inferior, globose, the apex somewhat depressed. Style 3–4 mm long, erect, glabrous; stigma punctiform. Berry globose, purple at maturity, 4–5 mm in diameter; seeds 0.5 mm long, pyramidal, the testa muriculate to papillate.

DISTRIBUTION AND PHENOLOGY.— Known only from the Pacific slope of Costa Rica, from Turubares to the Península de Osa south to Panamá, where it has been collected at Puerto Armuelles on the Burica Peninsula from sea level to 600 m. Collected in flower between November and January and in fruit between November and June.

PARATYPES.— COSTA RICA: Puntarenas: Puerto Jiménez, Agujas, 08°33'N 83°23'W, 23 Jan. 1995, Aguilar & Azofofeifa 3710 (CAS, CR, INB, MO); Parque Nacional Corcovado, Estación Sirena, Sendero Ollas, 08°28'N 83°35'W, 9 Feb. 1994, Aguilar 3103 (CAS, CR, INB, MO); Parque Nacional Corcovado, Estación Sirena, Sendero Espaveles, 08°28'N 83°35'W, 16 Jan. 1997, Aguilar 4977 (CR, INB, MO); west of Rincón de Osa, Península de Osa, 9–12 Jan. 1970, Burger & Liesner 7253 (CR); along abandoned “high road” W of Rincón de Osa, 8°42'N 83°31'W, 4 Mar. 1985, Croat & Grayum 59849 (CAS, CR, MO); fila before Rancho Quemado, near Rincón, 08°42'N 83°33'W, 11 Jan. 1993, Gentry et al. 78687 (CAS, INB, MO); cerca del rio Piro, Peninsula de Osa, 29 Dec. 2004, Kriebel et al. 5046 (CAS, CR, INB, MO); Aguabuena, 3 km W of Rincón, 800 m N of house of Henry Monge, 4 June 1993, Thomsen 361 (CR). PANAMA. Chiriquí: Burica Península, San Bartolo Limite, 12 miles west of Puerto Armuelles, 24 Feb. 1973, Liesner 201 (CAS, CR).

DISCUSSION.— *Miconia dissitinervia* shares a number of diagnostic characters with *M. centrosperma* of Panamá. Both species have plinerved leaves, blunt calyx teeth, a completely inferior 5-locular ovary, unappendaged anther connectives and a punctiform stigma. They are easily separated by the characters enumerated in the key below. *Miconia dissitinervia* has been misidentified in the past as *Miconia argentea* (Sw.) DC. probably because of the shared stellate indument on abaxial foliar surfaces. *Miconia dissitinervia* differs from the latter in having plinerved vs. nerved foliar venation, a punctiform stigma vs. clavate-crateriform stigma, unappendaged anthers vs. appendaged anthers, an irregularly rupturing hyaline calyx vs. nonrupturing regularly developed calyx lobes, and seeds with a muriculate or papillate testa vs. an angulate, smooth testa.

Key to the Mesoamerican species of *Miconia* with a fused calyx that ruptures at anthesis.

1 Flowers 4-merous

2. Distal branches, petioles, and inflorescence densely covered with a mixture of rusty brown sessile-stellate and stipitate-stellate hairs; flowers with pedicels to 0.5 mm; anther pore somewhat ventrally inclined; connective neither prolonged nor appendaged

..... *M. calocoma* Almeda

- 2' Distal branches, petioles and inflorescence sparingly and deciduously covered with stellulate hairs and/or minute glands or uppermost internodes and adaxial petiolar surface sparsely covered with smooth hairs and minute and appressed glandular hairs; flowers sessile or essentially so; anther pore dorsally inclined; connective appendaged dorso-basally

- 3 Leaves 5-nerved; stigma not expanded; ovary (2)–3-locular

..... *M. valeriana* (Standl.) Wurdack

- 3' Leaves 5-plinerved; stigma capitate; ovary 4-locular

1' Flowers 5(–6)-merous

- 4 Abaxial leaf surface completely covered with an indumenta of stellate or stellate-lepidote hairs resulting in a white to reddish-white color

- 5 Leaf blades 7.5–12 × 2.4–4 cm, 3-plinerved, stellate-lepidote abaxially; inflorescences 2–2.5 cm long; petals glabrous; ovary apex densely setose around the stylar scar; seeds with a conspicuous spur at the wider truncate end

..... *M. centrosperma* Almeda

- 5' Leaf blades 10–35 cm × 5–15 cm, 5-plinerved, stellate abaxially; inflorescences 8–10 cm long; petals papillose adaxially; ovary apex glabrous; seeds lacking a conspicuous spur on the truncate distal end

..... *M. dissitinervia* Kriebel, Almeda & Estrada

- 4' Abaxial leaf surface variously pubescent but never completely covered with a conspicuous white or reddish-white indument

- 6 Abaxial leaf surface minutely and deciduously glandular-punctulate to glabrous on the actual surface and copiously beset with tufts of stalked-stellate hairs where the innermost primary veins diverge from the median vein; ovary 3-locular

..... *M. mexicana* (Bonpl.) Naudin

- 6' Abaxial leaf surface variously pubescent but never beset with tufts of stalked-stellate hairs only where the innermost primary veins diverge from the median vein; ovary (4) 5-locular

- 7 Leaf blades 5–7-plinerved; flowers on pedicels 0.5–2.5 mm

- 8 Leaves subsessile and clasping or sometimes with petioles 1–5(–9) mm long; stamens dimorphic, the larger ones antepetalous

.... *M. dissitiflora* Almeda

- 8' Leaves with petioles 1.5–9 cm long; stamens isomorphic

- 9 Young cauline internodes, petioles, and hypanthia densely covered with inconspicuously stalked asperous-headed hairs; inflorescence erect and branched basally at the node from which it is initiated; mature leaf blades 5-plinerved.

..... *M. friedmaniorum* Almeda & Umaña

- 9' Young cauline internodes, petioles, and hypanthia densely covered with a lanate indument of curly or sinuate barbed or distally bifid hairs that are intermixed with and grade into a ground layer of shorter amorpho-pinoid hairs; inflorescence arcuate or pendent and branched well above the node from which it is initiated; mature leaf blades 7-plinerved

..... *M. pendula* Umaña & Almeda

- 7' Leaf blades 3–5-nerved; flowers sessile or essentially so

- 10 Branchlets, petioles, elevated primary leaf veins beneath, and inflorescences densely covered with stalked-stellate hairs; bracteoles oblong
 *M. dorsiloba* Gleason
- 10' Branchlets, vegetative buds, inflorescences, and hypanthia sparsely and deciduously stellulate-furfuraceous or uppermost internodes, adaxial surfaces of the petioles and leaf blades sparsely covered with smooth hairs (gland-tipped in part) 0.5–2.5 mm long underlain with minute glandular hairs; bracteoles setiform or subulate-setose
- 11 Leaf blades 6–20 × 3–8.9 cm, 5-nerved, adaxially sparsely covered with smooth hairs (gland-tipped in part) 0.5–2.5 mm underlain with minute glandular hairs; petals glabrous; stigma capitate
 *M. valeriana* (Standl.) Wurdack
- 11' Leaf blades 12–39 × 6.5–20.5 cm, 3-nerved, glabrous; petals densely granulose-papillose; stigma barely expanded. . *M. lamprophylla* Triana

ACKNOWLEDGMENTS

We are grateful to Silvia Troyo (Fig. 1) and Claudia Aragon (Fig. 3) for the illustrations and Alan Chou and Dominique Jackson for technical assistance. The first author thanks Daniel Solano, Daniel Santamaria, Barry Hammel and Reinaldo Aguilar for companionship on field trips that resulted in some collections of the new taxa treated here. Two anonymous reviewers also offered most useful comments. The photographs in Figure 2 were taken by Ricardo Kriebel.

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(Compiled by Michele L. Aldrich and Alan E. Leviton).



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Atlas of Phylogenetic Data for Entelegyne Spiders (Araneae: Araneomorphae: Entelegynae) with Comments on their Phylogeny

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